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Resistance to Change? Surgical Perspective, Practice and Antimicrobial Stewardship in Routine Inguinal Hernia Repair

Mohamed Saad Aboul-Enein[1,2], Kanchana Niruttan[1], Vinay Shah[1], Roisin Johnson[1], Peter Pipan[1], Cara Baker[1], Husam Ebied[1,3], Mohamed Ghazaly[2*]

[1]Department of Surgery, Guy's & St Thomas' Oesophago-gastric Centre,London, United Kingdom
[2]General Surgery Department, Faculty of Medicine, Tanta University, Tanta, Egypt
[3]General Surgery Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt

***Corresponding author:**
Mohamed Ghazaly, MD
Department of Surgery
Tanta University Hospitals
El-Gaish, Tanta Qism 2, Tanta Gharbia Governorate
Postal code: 31512, Egypt
Tel.: 002 01112137427
E-mail: mohamed.ghazaly@med.tanta.edu.eg

ABSTRACT

Background: Nearly twenty million elective inguinal hernia repairs are performed annually worldwide. International guidelines show no evidence for perioperative antibiotics in either patients at low risk of surgical site infections (SSIs) undergoing open hernia repair or in laparoscopic hernia repair in any context.
Methods: A series of 85 day-case inguinal hernia repairs at a central London teaching hospital were evaluated to ascertain rate of prescription of prophylactic antibiotics. Data collected including operative management, comorbidities and use of antibiotics. Patients stratified as high or low risk based on co-morbidities. A survey of 86 surgeons of various grades across several UK hospitals was performed regarding the prescription of peri-operative antibiotics.
Results: Perioperative antibiotics were prescribed in 80%, 68 patients of routine hernia repairs, only 28%, 24 were considered high risk of SSIs. Fifty-three percent of survey respondents, 46 reported prescribing antibiotics in all inguinal hernia repairs while a further 3%, 3 prescribed antibiotics only in open repairs and 1%, 1 used antibiotics only with mesh. Incongruously, 67%, 58 of respondents felt antibiotics should NOT be routinely prescribed.
Conclusion: Rates of antimicrobial prescription seen in elective hernia repair are not concordant with national and international guidelines. Multiple factors contribute to this including personal experience, training, and perceived cost-benefit. This study flagged a degree of resistance to change in prescribing practices and highlighted possible avenues of continuing professional development.
Key words: inguinal hernia repair, surgical site infection, antimicrobial therapy

INTRODUCTION

Annually an estimated 100,000 elective inguinal hernia repairs are performed in the UK (1). Eighty-two percent of inguinal hernia repairs involve the use of a mesh (1). A 2020 Cochrane review of 27 studies found no evidence of benefit of perioperative antibiotics in preventing surgical site infections (SSIs) associated with low risk herniorraphy (2). It concluded there was no indication

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for prescription of prophylactic antibiotics in low infection risk environments (< 5% infection rate) but that there may be some benefit to administration of antibiotic in high-risk environments (≥ 5% infection rate)(2). Other studies have come to the opposite conclusion. A 2013 meta-analysis of 12 studies by Mazaki et al concluded that "antibiotic prophylaxis is efficacious for the prevention of SSI after open mesh hernia repair" (3) as did a 2007 meta-analysis by Sanabria et al of 6 studies (n=2507)(4).

Antibiotic resistance represents "greatest challenge to the effective treatment of infections globally" (5). An estimated 20-50% of antibiotic prescriptions are excessive or inappropriate (5). Rational antibiotic prescription is a key strategy to decreasing levels of antibiotic resistance (6).

Guidelines are consistent regarding the peri-operative prescription of antibiotics in inguinal hernia repair in low-risk patients. UK, European (8) and International (9) guidelines all suggest routine antibiotic prophylaxis is not indicated in low risk open inguinal hernia repair or in laparoscopic hernia repair. NICE guidelines however suggest prescription of prophylactic antibiotics is indicated in 'clean' procedures that involve implantation of a foreign body (10).

This study aimed to evaluate the use of prophylactic use of antibiotics in a central London teaching hospital. Additionally, it aimed to understand perspective of surgeons influencing anti-microbial prescription.

METHODS

Data from 100 day-case hernia repairs performed at central London teaching hospital were collected. Collection included both open and laparoscopic elective inguinal hernia repairs. Cases were excluded if paediatric (< 18 yrs old) or complicated procedures. All hernia repair procedures were performed in common-pool multi-speciality surgery theatres. Eighty-five sets of patient data were analysed in total. Data collected including operative management, medical comorbidities and use of antibiotics. Patients were stratified as high or low risk based on the presence or absence of co-morbidities.

An online survey created using the google form platform was sent to surgical registrars and consultants across several UK hospitals. Information gathered included grade, specialty, volume of inguinal hernia repairs performed, practice in antimicrobial prescription and rationale for practice (*table 1*). Data was tabulated and analysed.

Data were analysed using (SPSS) version 20. Quantitative data were expressed as mean and standard variation (SD). Qualitative data were expressed as frequency and percentage.

Table 1 - Questionnaire parameters (Antibiotics in Hernia Repair- Surgical perspectives)

What grade are you?
SHO (F3/ CT1-2/ST1-2)
ST (3-5)
ST 5+
Consultant
What surgical specialty do you work in?
General Surgery
Colorectal Surgery
Upper GI Surgery
Breast Surgery
Emergency
Bariatric and abdominal wall Surgery
How many inguinal hernia repairs do you perform in a month on average?
Roughly how many are open?
Roughly how many are laparoscopic?
Do you perform inguinal hernia repairs independently?
Yes
No
How frequently do you prescribe intraoperative anti-biotics in routine hernia repairs?
Always
In patients with high risk of surgical site infection only
Never
Other
Are you familiar with the 2018 international guidelines on routine hernia repair?
Yes
No
Somewhat
Are there any other factors that influence your decision to prescribe antibiotics in routine hernia repair? (please select all that apply)
Personal experience of surgical site infection
Experience of colleagues with surgical site infections
Teaching from mentors or senior colleagues
Peer reviewed evidence suggesting benefit
Other:
Do you think antibiotics should be prescribed routinely in routine hernia repair?
Yes
No
If so why?

CT - core training, SHO - surgical house officers, ST - surgical training

RESULTS

Series

Eighty-Five sets of patient data were analysed in total. Eighty patients were male and five were female with a mean age of 55.1 years (55.1 ± 14.8). Data collected including operative management, medical comorbidities and use of antibiotics. Patients were stratified as high or low risk based on the presence or absence of co-morbidities. Twenty-four patients, 28.24% were considered high risk on the basis of

immunosuppression, malignancy or diabetes, (*table 2*) with more than one patient presenting with multiple co-morbidities, while 72%, 61 patients were considered low risk. Perioperative antibiotics were prescribed in 80%, 68 patients. This represents a significant over prescription of peri-operative antibiotics.

Survey of surgical perspectives

One hundred surgeons were contacted, with a total of eighty-six responses to the survey were received. Respondents represented a range of training grades. Thirty-seven surgeons, 43% were consultants, twenty-six, 30% were ST5 and above, thirteen, 15% were ST3-5 and ten, 12% were SHOs, where ST means speciality training doctors in UK, starting at year 3 which is ST3 and finishing at year 8 (ST8). SHO is surgical house officers that are still doing their core surgical training and haven't started their speciality training yet. This explains that some of these SHOs and STs do not perform hernia surgery independently and they need some either scrubbed or un-scrubbed supervision depending on their level of training (*table 3*).

Responses were from a range of subspecialties, general surgery and colorectal surgery each represented 31%, 27 responses. 24%, 21 were upper GI, 7%, 6 were breast, 3%, 3 were emergency surgery and 1%, 1 was bariatrics and abdominal wall.

Eighty-four percent, 72 respondents performed hernia repairs independently while 16%, 14 were supervised. Mean number of hernia repairs performed per month was 8.80 (SD ± 5.28) though this ranged from 1-25. Mean number of open hernia repairs per month was 6.4 (SD ± 4.53) and mean laparoscopic hernia repairs were 2.37 (SD ± 4.27) (*table 4*).

Fifty-three percent of respondents, 46 reported prescribing antibiotics in all inguinal hernia repairs while a further 3%, 3 prescribed antibiotics only in their open hernia repairs and 1%, 1 prescribed antibiotics if using a mesh. Thirty-seven percent, 32 reported prescribing them in patients at a high risk of surgical site infections (SSI) and 5%, 4 reported never prescribing antibiotics (*figure 1*).

Incongruously, 67%, 58 respondents felt antibiotics should NOT be routinely prescribed in hernia repair while 33%, 28 felt they should be.

52%, 45 respondents reported being familiar with hernia guidelines while 27%, 23 reported being 'somewhat familiar'. 21%, 18 reported that they were not familiar with current hernia guidelines (*figure 2*).

Respondents cited multiple factors influencing their decision to prescribe antibiotics in hernia repair including personal experience of surgical site infection (35%, 30 respondents), experience of colleagues with surgical site infections (29%, 25), teaching from mentors or senior colleagues (56%, 48), and peer reviewed evidence suggesting benefit (23%, 20). Other factors reported included 'Guidelines', 'Clinical judgement' and fear of complications from mesh infection (*figure 3*).

Table 2 - High risk patients' co-morbidities

Co-morbidity	Total number of patients (24)
Diabetes Mellitus	13 (54.2%)
IDDM	1
NIDDM	12
(Diet controlled)	6
(Medical treatment)	6
Malignancy/Immunocompromised	9 (37.5%)
Malignant Neoplasm of Bronchus and Lung	1
Bladder Carcinoma	1
Anal Carcinoma	1
Chronic Myeloid Leukaemia	1
Basal Cell Carcinoma	2
Iron Deficiency Anaemia	3
Severe Respiratory/Cardiovascular Insufficiency	17 (70/1%)
COPD	2
Severe LVH	2
Hypertension	13

COPD - chronic obstructive pulmonary disease, IDDM - insulin-dependent diabetes mellitus, LVH - left ventricular hypertrophy, NIDDM - non-insulin-dependent diabetes mellitus

Table 3 - Grade and specialty of respondents

Grade	
Consultant	37
ST5+	36
ST3-5	13
SHO	10
Specialty	
General Surgery	27
Colorectal Surgery	27
Upper GI Surgery	21
Breast Surgery	6
Emergency Surgery	1
Bariatric and Abdominal Wall Surgery	2

Table 4 - Mean and variance in numbers of routine hernia repair performed

Procedure	Total	Open	Laparoscopic
Mean	8.802326	6.319767	2.367442
St Dev	5.275515	4.534127	4.277119

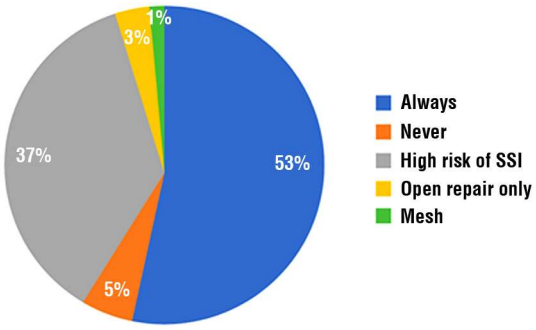

Figure 1 - Reported Rates of prescription of antibiotic prophylaxis in routine hernia repair

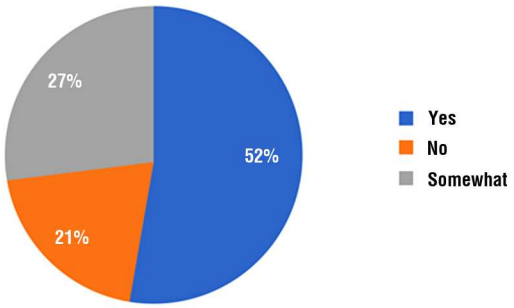

Figure 2 - Reported familiarity with most recent guidelines

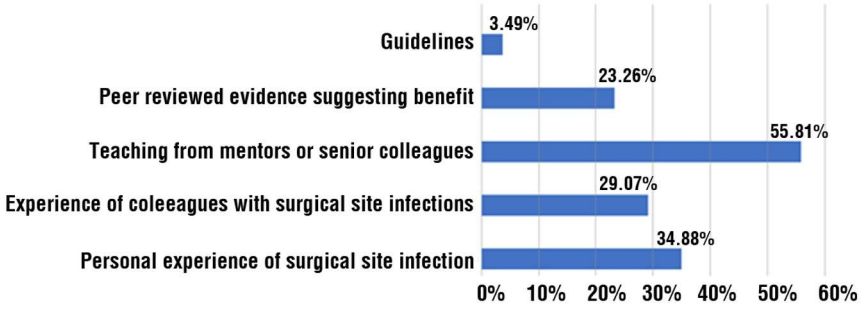

Figure 3 - Reported factors influencing decision to prescribe antibiotics

DISCUSSION

There are currently two major guidelines around hernia repair. The European Hernia Society does not recommend the use of prophylactic antibiotics in open repairs in low-risk patients or in endoscopic procedures (8). The same recommendation is made by current international hernia guidelines (9). International guidelines do recommend the use of antibiotics in 'high risk environments' with >5% pf patients at risk of an SSI (9).

Of note there is a lack consensus of what constitutes a patient at 'high risk' of an SSI. European guidelines suggest several factors can be considered including patient factors 'recurrence, advanced age, immunosuppressive conditions' and procedural factors 'expected long operating times, use of drains' (6). International guidelines in contrast acknowledge a lack of accepted definition of 'high-risk' and have recommended further study around the need for antibiotics in this patient population (9).

While hernia repair is considered a 'clean procedure', they generally have higher than expected rates of infection (11). A 2012 Cochrane review noted infection rates of 3.1% in prophylaxis and 4.5% in control groups, (OR 0.64, 95% CI 0.50 - 0.82) (12). This review did not however recommend universal use of antibiotics.

An interesting comparison cited by the Hernia Surge group is that of national hernia registers. The German national register reports antibiotic use in 70% of patients with infection rates of 0.2-0.6% in contrast the Swedish Inguinal hernia register reports antibiotic use in 5.6% of patients post op infection rates of 1.2-1.5% (9).

Globally, studies have found variable compliance with surgical antimicrobial prescribing guidelines. A Greek study in 2000 found antibiotics were unnecessarily prescribed in 19% of operations studied. With a guideline compliance rate of 66.6% for open inguinal hernia repair specifically (13). A 2005 Malaysia study described antimicrobial prescribing in elective surgical procedures as 'haphazard'. It found antibiotics had been administered in 59.6% of elective hernia repairs. While it considered single dose prophylaxis in inguinal hernia repair it found prophylaxis had been 'inappropriately prolonged' in 31% of cases (14).

On assessment of an 85 patients series at a London teaching hospital, patients undergoing routine hernia repair, 72%, 61 were considered low risk on the basis of

immunosuppression, malignancy, diabetes, or respiratory/cardiovascular compromise while 28%, 24 were considered high risk. Perioperative antibiotics were prescribed in 80% of the cases, 68. This represents a significant over prescription of perioperative antibiotics but also reflects surgical concerns around SSI in a supposedly 'clean' procedure.

This survey around prescribing practices was distributed among surgeons at several UK hospitals to better understand surgical perspective on antimicrobial prescribing. A reasonable range of specialties and training levels were represented among respondents. A majority (53%) were noted to prescribe antibiotics in all inguinal hernia repair although interestingly a majority (67%) did not think antibiotics should be routinely prescribed in this situation.

The results were consistent the small number of similar studies available in published literature. A 2007 study in Wales found 78% of surgeons routinely used antibiotics prophylaxis in inguinal hernia repair (15) while a 2013 cross sectional study of London and South East England found 84% of surgeons supported the use of single dose pre-operative IV antibiotic prophylaxis (16). A 2018 survey of surgeons in England found lower rates, reporting 44 % of surgeons administered routine antibiotic prophylaxis and 49.4% did so selectively (17). Across the pond, 2020 US Department of defence audit found 95% of surgeons prescribed prophylactic antibiotics in open hernia repair with mesh and a further 84.2% prescribed antibiotics in laparoscopic hernia repair (18).

Respondents appeared to have been influenced by a number of factors, most significant of which was teaching from mentors and senior colleague followed by first and second-hand experience of surgical site infections. There is perhaps room for further education, more than a fifth, 21% of respondents reported not being familiar with the most current guidelines around hernia repair. This rate was higher among trainees, 29% compared to consultants. Of respondents who performed independent hernia repairs, consultants (59%, 22) were slightly more likely to prescribe antibiotics in all or all open cases compared to registrars (54%, 21).

One dose of IV Co-amoxiclav (the most common antibiotic prescribed in this study) costs between £10.60 and £39.70. If rates of antibiotics use noted in our study are representative of a wider picture this could potentially indicate a significant additional cost to the NHS given the roughly 71,000 inguinal hernia repairs carried out every year in the UK (19). It can also be argued that this contributes to growing tends in antimicrobial resistance (20). This must however be balanced with the high rates of SSI noted in Inguinal hernia repair and the use of mesh in a significant proportion of these procedures.

CONCLUSION

In conclusion, this study suggests that rates of antimicrobial prescription in routine hernia repair are higher than would be expected. These are often the decision of the operating surgeon. Thirty-seven percent, 32 of respondents only prescribed antibiotic as guidelines suggest in patients at a high risk of SSI. This potentially represents a significant degree of over-prescription of intra-operative antibiotics and the implications of cost and possible antimicrobial resistance this comes with. There is perhaps more work to be done on changing surgical perspectives on antimicrobial prescribing in low-risk cases. Senior surgeons who will train and mentor the next generation are an important group to target as their practice echoes down generations. It must be noted, there is a need for further research in the area and a consensus around what constitutes a 'high-risk' patient if guidelines are to be followed consistently.

Conflicts of interest and source of funding

The authors declare no conflicts of interest.

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Ethics of approval

Ethical approval for use of the database through an integrated research application system (IRAS reference: 12-NW-0511).

Author's contributions

Mohamed Saad Aboul-Enein: conception, design, data collection, data analysis, drafting. Kanchana Niruttan: data collection, data analysis, drafting. Vinay Shah: data analysis and interpretation. Roisin Johnson: data collection. Peter Pipan: data collection. Cara Baker: data collection, conception. Husam Ebied: conception, design, final approval of the version to be published. Mohamed Ghazaly: data analysis, drafting and finalization of manuscript.

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