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Original Research

Training of Future Surgeons in Minimally Invasive Surgery Needs Intensification: A Multicentre Study

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ABSTRACT

Introduction
The advent of minimally invasive surgery with its many benefits for both patients and surgeons has meant that increasingly more operations are nowadays performed laparoscopically. With the current study, we aim to look at the exposure trainee doctors and in particular first year trainees, currently have in laparoscopic surgery.

Materials and Methods
A 16-question survey was circulated to the first-year trainee doctor cohort of 13 UK Hospitals. The questionnaire focused on confidence with 5 basic laparoscopic skills, undergraduate teaching and postgraduate teaching.

Results
A total of 64 responses out of 302 questionnaires sent were returned. Of the respondents, 63.5% had General Surgical placements. General confidence with basic laparoscopic skills was low with only 33% of respondents reporting confidence with these skills, whereas only 25% of respondents received adequate teaching on laparoscopic skills during medical school. At postgraduate level, only 8% of respondents stated they had any formal teaching in laparoscopic skills during their foundation year.

Discussion
From our study it is clear that experience of first-year training doctors in laparoscopic surgeryis low. Most respondents had very little teaching or hands-on experience in laparoscopic skills as undergraduates. At training level, again there was little dedicated teaching.

Conclusion
This study shows that the current training in laparoscopic surgery both in medical school and foundation training is not optimal. Basic skills can be taught with relative ease and these skills are directly transferable to the operating theatre environment. We propose that changes must be made to the training programme to better prepare junior doctors.

Keywords
Minimally invasive surgery; Laparoscopic surgery; Surgical skills; Surgical training programme; Junior doctors; Future surgeons; Post-graduate medical teaching.

Surg Res Open J. 2018; 5(1): 1-13. doi: 10.17140/SROJ-5-122

INTRODUCTION

The advent of laparoscopic surgery with its many benefits for both patients and surgeons have meant that increasingly more operations are now performed laparoscopically. For junior doctors this rise means that a large proportion of the operations they see and the patients they care for post-operatively have had laparoscopic procedures.

One key aspect of the laparoscopic approach is that even relatively simple operations such as appendicectomy cannot be performed independently. There is always a need for an assistant to operate the camera and provide an optimal view of the operative site for the surgeon. In many hospitals, this responsibility is usually that of the junior members of the surgical team.[1] Despite this role being vital for the operation, often the junior doctors drafted into providing this service have very little prior experience.[2] The consequence of this is increased operating time and substandard views for the operating surgeon due to the junior doctors lack of familiarity with laparoscopic principles.[3] During normal working hours there may be other more experienced trainees available to step in and assist but out of hours, in many hospitals, the only assistant available may be a first-year training doctor.[3]

Undergraduate exposure to laparoscopic surgery is limited to very few UK medical schools having dedicated teaching on the subject. Furthermore, in the current foundation year curriculum there is no specific requirement for trainees to attain surgical skills let alone laparoscopic skills.[4]

Modern computing and video game technology means that current trainees have a greater aptitude for the technical skills needed for laparoscopic surgery.[5] It has been shown that the tuition of basic laparoscopic skills on commonly available simulators provides trainees with skills that are directly transferable to the operating theatre.[6] This highlights the fact that there is a prime opportunity for enhancing trainee learning as studies have shown that technical performance during real-time surgery is improved when there is prior training on models.[6] In turn, it has been shown that learning on these models prior to theatre confers to greater time efficiency when performing simple skills.[2,6]

Currently, the training pathway into surgery for UK graduates is relatively linear. After medical school, it is compulsory to complete 2 foundation training years rotating usually through 6 different specialities (4-monthly placements) which usually, but not always, includes the trainees desired future speciality. During the second foundation year, trainees apply for core surgical training, which is a 2-year training program themed to their chosen surgical speciality but also including allied surgical specialities. At the end of this, trainees will finally apply for higher surgical training into their chosen speciality, which typically lasts from 4 to 6 years.

Even though not all year one trainees passing through a general surgical rotation aspire to become surgeons this should not prevent them from gaining surgical experience. Laparoscopic surgery is widespread and most specialities especially general practice will deal with or refer patients on to general surgery. As such it is vital that all trainees appreciate the basic concepts of these procedures in order to understand the patient's surgical experience.[1] In surgery, the best way to do this is to assist and observe these procedures directly in order to understand how patients are treated and appreciate how certain post-operative complications arise.[7,8]

With the increasingly competitive entrance into surgical training, junior doctors are required to make career decisions far earlier than their more senior peers. Core surgical training applications are now submitted at the beginning of foundation year 2 thus junior doctors may only have their foundation year 1 to make their decision. Evidence shows that the vast majority (88% men and 79% women) of surgical trainees made their decision after the end of their first year.[9] This limited timeframe highlights that career decisions can be made with very little experience, thus it is vital that junior doctors get adequate exposure in order to make an informed career choice.[9]

In this study, we aim to look at the exposure junior doctors, in particular, year one trainees, currently have in laparoscopic surgery. The main reason for including year 1 trainees, was that studies show that decision to pursue surgical training is shaped primarily in the first year of training.[9] Hence, we wished to assess the quality of training received in the lead up to foundation year 1 and during the foundation year 1 year. Furthermore, applications to core surgical training are at the beginning of foundation year 2 (FY2) thus the training and experience that leads up to this decision are primarily in foundation year 1. With this study, we assess undergraduate training and identify potential areas of weakness in the current Foundation Year programme with respect to developing laparoscopic surgical skills.

MATERIALS AND METHODS

We created a questionnaire using Google Survey comprising of a total of 16 questions (Appendix 1). This was sent to Year 1 training doctors in East of England, London and Midlands's area. The survey was designed by the authors in order to assess foundation year past and present training and also confidence in operative skills. Dissemination of questionnaires was made *via* Foundation Training doctor coordinators at trusts across England. Further numbers were elicited by asking trainee doctors to complete surveys during mandatory teaching and training sessions. All trainees were invited to complete the email-sent questionnaire, but was not compulsory for them to complete it. Regular email reminders were sent over a 2-month period, after which data collection ended and returned questionnaires were analysed. A total number of 302 questionnaires were sent to 13 different hospitals. All questionnaires were made anonymous after submission and no personal or identifiable data was recorded. A total of n=64 completed responses were received from trainees. For the sample year, there were n=7638 Foundation Year 1 Trainees across the United Kingdom, with n=572 of them being in the relevant deaneries. A margin of error was then calculated for sample size using standard margin of error statistical calculation with 99% confidence level. The margin of error of results in regards to total number of trainees in deanery sampled (n=572) was 16%, while the margin of error of results in regards to total number of FY1's in sample year (n=7638) was 17%.

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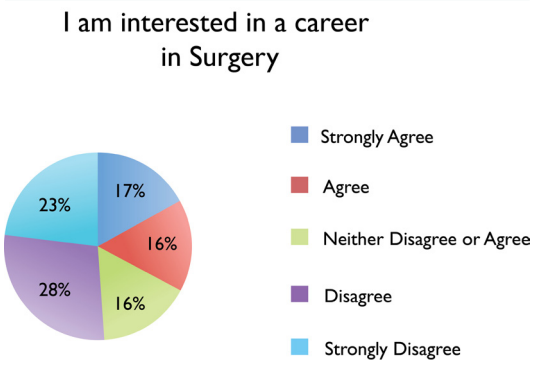
RESULTS

A total of n=64 out of 302 questionnaires were fully completed and returned (response rate 21.3%). Fifty-three percent of respondents were female and 47% male. All respondents had undergraduate training in the UK and represented 12 different medical schools from across the country. Sixty-three percent of respondents had General Surgical placements in their foundation year one with 52% having surgical on-call night shifts during their placement.

Those questioned had varying interest in surgery as a future career with a greater majority (51%) not wishing to pursue a surgical career (Figure 1).

Figure 1. *Interest in Surgery as Future Career*



Of the respondents that had general surgery placements most felt they had adequate opportunities to assist and gain experience in theatre with 77% of respondents either strongly agreeing or agreeing with the above statement (Figure 2). Eighty percent of those surveyed with general surgery placements were able to go to theatre 1-2 or 2-3 times per week, with 17% of respondents being unable to go to the theatre at all during the week. A contributing factor to this was the intensity of work on the ward with 40% of respondents agreeing or strongly agreeing that ward work prevented them from going to the theatre (Figure 2).

To assess confidence in basic laparoscopic principles and skills we asked respondents 5 questions that covered the tasks early years training doctors are commonly asked to assist in during theatre. There was a wide range of confidence levels in these skills (Figure 3). When it came to understanding laparoscopic cameras only 37% of respondents felt they knew the different types available and additionally only 33% the differences in the images they produced.

In regards to gaining laparoscopic access and the principle of insufflation, an understanding was better, with 50% strongly agreeing or agreeing that they understood the underpinning principles. When it came to port placement this was not the case, with only 33% strongly agreeing or agreeing that they were confident with how this was done. Finally, only 25% of respondents felt confident in using basic laparoscopic tools when asked to assist in theatre (Figure 3).

Majority of respondents (67%) felt they were able to develop the basic skills outlined in previous questions in the questionnaire during their general surgery placement (Figure 4). This especially correlated with those respondents who were able to attend theatre more often during the week.

The final part of the questionnaire focussed on the standard of teaching, foundation year doctors received both as under-graduates and post-graduates. When it came to undergraduate training only 25% of all respondents strongly agreed or agreed that they had received adequate teaching on laparoscopic skills during medical school. Furthermore, only 29% of all respondents had training on basic skills using laparoscopic trainers/models at any stage of their training. Most undergraduate teachings were *via* one-off sessions in medical schools that had available simulation suites or by self-organised sessions with box trainers (Figure 5).

Figure 2. *Opportunity for Theatre Experience*

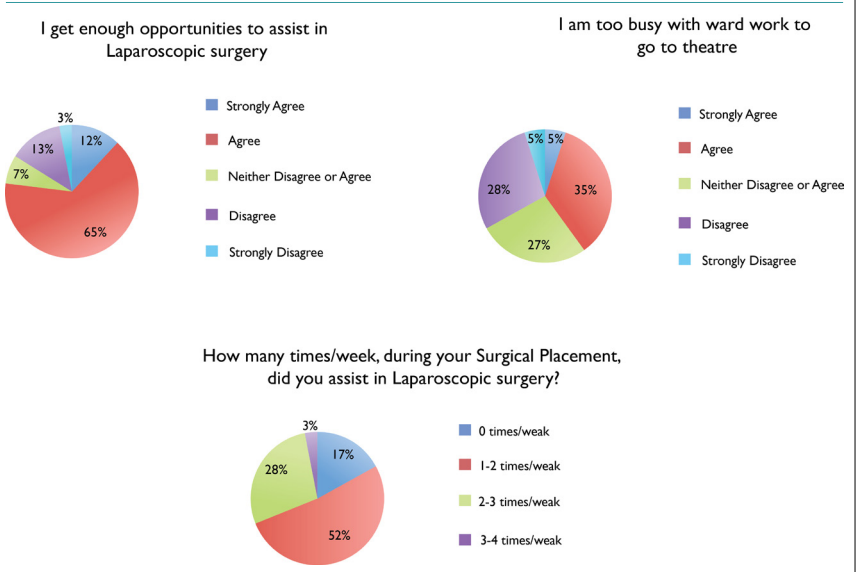


Figure 3. *Confidence with Basic Laparoscopic Skills*

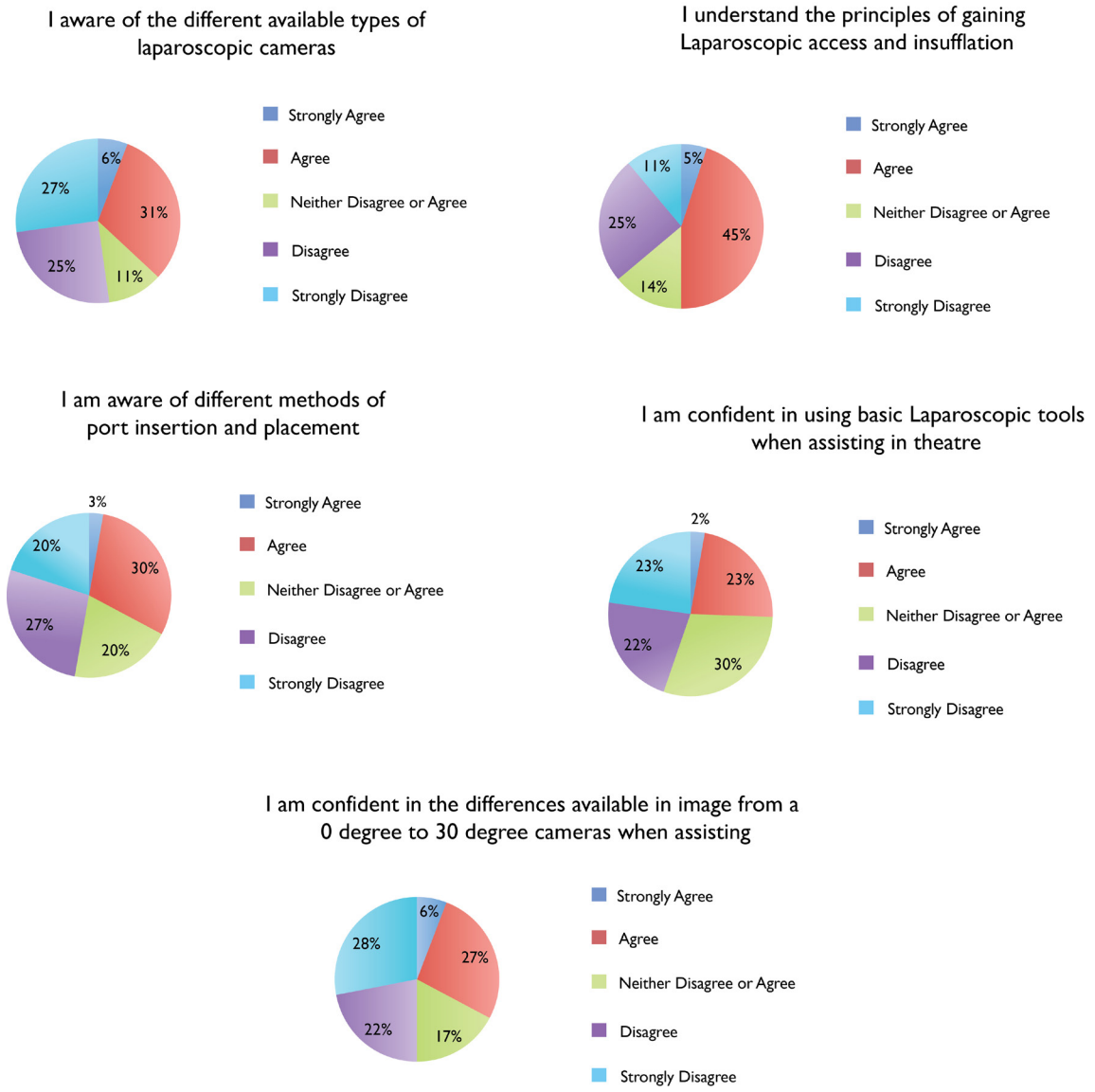
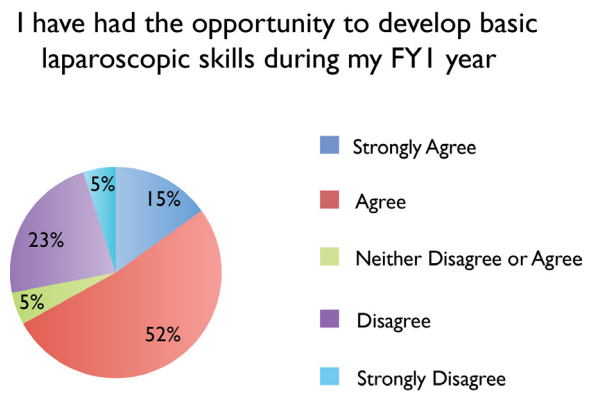


Figure 4. *Development of Basic Laparoscopic Skills during First Year of Training*

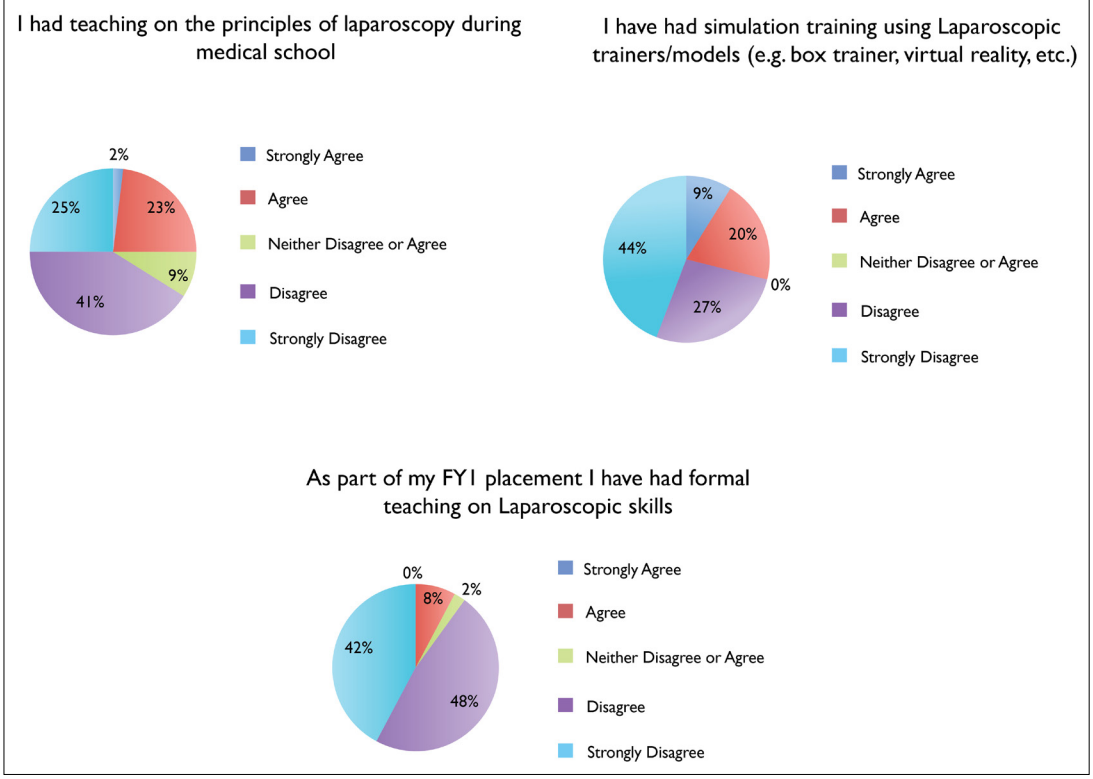


Post-graduate training was mainly compromised of on-the-job training and to lesser extent self-funded courses. Only 8% of all respondents stated they had any formal laparoscopic skills teaching during their Foundation year. Most teaching came from assisting in theatre and getting informal teachings from seniors. Thirteen percent of respondents attended courses with nearly all of them attending the Royal College of Surgeons "Basic Surgical Skills" course (Figure 5).

DISCUSSION

From the study, it is quite clear that first year junior doctor's experience in laparoscopic surgery is low. Most respondents had very little teaching or hands-on experience in laparoscopic skills as undergraduates. In the first year of training, weekly theatre time was also limited to an average 1-2 times per week. In conjunction, this

Figure 5. *Undergraduate and Post-graduate Teaching Exposure*



leaves very little time to develop and practice basic skills.[10]

Studies show that when 'laparoscopic naive' trainees receive systematic training using laparoscopic simulators they develop basic skills that are directly transferable to the operating theatre.[2,11,12] Students who received prior simulation sessions gained proficiency more quickly, were more comfortable assisting in theatre and were more time efficient.[2,7,13] Systematic review shows strong evidence supporting the fact that simulation training shows general increase in proficiency at all grades of training and shortens the learning curve for real laparoscopic procedures.[7,8,14] However over the long-term this effect has not been shown to persist over numerous subsequent procedures.[8,14] This shouldn't be considered a disadvantage in this case as most foundation doctors spend 4 months rotating through a surgical speciality. Hence the short-term benefits that could potentially be gained from simulation training would be invaluable.

The most common role for foundation doctors within the surgical team is that of the assistant, which in laparoscopic surgery is mainly comprised of manipulating the camera and the use of simple tools to assist the surgeon.[15] Though these are skills that can be taught with relative ease, tuition intra-operatively isn't the most effective introduction to them.[15] Prior simulation sessions would confer to greater proficiency and confidence from the very first case a junior doctor assists in.[16] This would be an asset for the entire surgical team, as less time would have to be dedicated to teaching the basics during precious theatre time. Only a small proportion of our respondents were confident with the basic skills needed. Nevertheless, they mostly agreed that they could build on these skills during their rotation with 67% stating so, despite regular theatre time being scarce. Concurring with the published literature, it is evident that the amount of time junior doctors spenddurring their first year in theatre is low with most time being spent on the ward.[17] Thus it is imperative that they are able to maximize the time that they do spend there. When trainees have an understanding of the basic skills prior to the theatre they are able to spend time developing more complex skills.[18]

Simulation training is a safe and cost-effective method of training basic laparoscopic skills.[19] Students are much more comfortable training in the safe confines of a simulation suite. Learning to manipulate and to provide a view with a camera under the stresses of a real-time operation is not conducive to learning. Basic skills teaching can be delivered effectively and with little cost.[20] Using local education center resources and local faculty basic skills can be taught with relative ease.

There is clearly a lack of exposure to hands-on surgical skills development in medical school as evidenced by the fact that only 25% of our respondents from 12 different UK medical schools felt they received adequate teaching. This is similar to findings in other studies that found a lack of formal practical skills teaching at the undergraduate level.[18,20] A lot of the experience respondents acquired was through self-directed learning, extra-circularly, for example, student-led simulation sessions or as part of a research project. At the post-graduate level the current foundation programme curriculum makes very little provision for the development of surgical skills and in particular laparoscopic skills.[4] From our respondents, from 13 different hospitals, only 8% received any

form of formal teaching on laparoscopic skills despite the fact that 63% of respondents had a general surgical rotation. This highlights the fact that there is a very real gap in surgical teaching at a junior level.

Thirty-three percent of our respondents were interested in a surgical career with 16% being unsure. Trainees who show an interest early, during the first year of training, are the most likely to succeed.[9,21] With the accelerated surgical training application at the beginning of the second year of training, trainees have very little time to gain adequate exposure in order to make an informed decision. Studies reveal that juniors who received surgical skills teaching were shown to have a greater interest in pursuing a surgical career afterwards; therefore, providing more formal hands-on experience early will allow the best and most motivated trainees to apply to higher surgical training.[20,22]

The study's main limitation is the low response rate to the circulated questionnaire (21%). This is difficult to interpret; one possible explanation may be a career choice away from surgery or lack of engagement/enthusiasm amongst early year trainees towards surgery that is currently noticed in the UK.[23] This is also supported by our study where 51% of respondents did not wish to pursue a surgical career. Nevertheless, the received responses provided a good cross-section of the trainees and hospitals available within the region. The surveyed trainees were all from the southern half of the country and as such this study does not take into account more broad regional variances in training across the UK. On the other hand, all trainees presented from medical schools from all across the UK.

CONCLUSION

Though there has been some work towards developing alternatives to the surgical assistant in laparoscopic surgery, with one example being the robotic camera assistant, there is currently no substitute for the status quo.[24] Therefore it makes perfect sense that the junior doctors who fill this vital role, are well trained and equipped for the job. It is clear that the current training is not the best that can or should be delivered and changes must be made to the training programme to better prepare junior doctors.

ACKNOWLEDGEMENTS

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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APPENDIX I

FY1 LAPAROSCOPIC SKILLS QUESTIONNAIRE

*Required

Name *

.....

Gender *

Mark only one oval.

- Male
- Female

Hospital *

.....

Medical School *

.....

1. I am interested in a career in Surgery *

Mark only one oval..

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

2. I have had a General Surgery Placement during my FY1 year *

Mark only one oval.

- Yes
- No

3. During my surgical placement I did night shifts *

Mark only one oval.

- Yes
- No

4. I get enough opportunities to assist in laparoscopic surgery *

Mark only one oval.

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

5. How many times/week, during your Surgical Placement, did you assist in laparoscopic surgery? *

Mark only one oval.

- 0
- 12
- 23
- 34
- >4
- Not Applicable

6. I am too busy with ward work to go to theatre *

Mark only one oval.

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

7. As part of my FY1 placement I have had formal teaching on laparoscopic skills *

Mark only one oval.

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

Please provide details of any sessions

.....

.....

.....

.....

8. I am aware of the different available types of laparoscopic cameras *

Mark only one oval.

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

9. I am confident in the differences in image from 0 degree to 30 degree cameras when assisting *

Mark only one oval.

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

10. I understand the principles of gaining laparoscopic access and insufflation *

Mark only one oval.

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

11. I am aware of different methods of port insertion and placement *

Mark only one oval.

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

12. I am confident in using basic laparoscopic tools when assisting in theatre *

Mark only one oval.

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

13. I have had the opportunity to develop the skills outlined in Q8 12 during my FY1 year *

Mark only one oval.

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

14. I have had simulation training using laparoscopic trainers/models (e.g box trainer, virtual reality, etc) *

Mark only one oval.

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

Please provide details of any models/trainers used

.....

.....

.....

.....

.....

15. I have attended courses/seminars to develop my laparoscopic skills (e.g Basic Surgical Skills Course) *

Mark only one oval.

- Yes
- No

Please state which courses/seminars attended

.....

.....

.....

.....

.....

16. I had teaching on the principles of laparoscopy during medical school *

Mark only one oval.

- Strongly Agree
- Agree
- Unsure
- Disagree
- Strongly Disagree

Please provide details of any teaching

.....

.....

.....

.....

.....

All Answers will be Anonymous

Thank you for taking the time to complete this survey

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Case Report

Melorheostosis: A Rare Cause of Limb Pain

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ABSTRACT

Melorheostosis is a rare skeletal dysplasia, and to date there are no reports of this condition in Australia. This is a case of a lady who presented with dull arm pain with a pathognomonic radiological findings. The plain radiographs obtained of the limb demonstrated a characteristic candle wax appearance in a monomelic distribution. The natural history, presentation, and management are discussed in detail.

Keywords
Melorheostosis; Skeletal dysplasia; Central Australia.

CASE PRESENTATION

An indigenous lady in her fifth decade was referred by her general practitioner to the orthopaedic clinic with 5-year history of a dull left upper limb pain. She had no significant medical history, nor history of trauma or infection. Physical examination revealed full range of motion of her affected limb wasting of thenar eminence, and positive Tinel's test at carpal and cubital tunnels. There were no other significant findings of her upper or lower limbs. Plain radiographs revealed diffuse cortical thickening and sclerosis, resembling candle wax, along the radial border of the hand and wrist diagnostic of melorheostosis (Figure 1). Similar findings were noted in the proximal humerus (Figure 2). Results of biochemical investigations for infection and metabolic bone screen were normal. The information with imaging was sufficient for a diagnosis of melorheostosis. Further investigations were organized to address the nerve compression symptoms, however, the patient defaulted follow-up.

Figure 1. *Classic Candle Wax Appearance Seen along the Radial Border of the Wrist and Hand*

Figure 2. *Similar Candle Wax Appearance of Melorheostosis Seen in the Proximal Humerus*

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DISCUSSION

Melorheostosis, first described in 1922, also known as Leri's disease, is a rare mesodermal bony dysplasia that may involve surrounding soft tissues.[1] The global incidence is approximately 0.9 per million population.[2] It is known for its classical appearance of periosteal cortical thickening in a "dripping wax" or "candle wax" form on plain radiograph. There are other known radiological patterns of this disease including osteoma like myositis ossificans like and osteopathiastriata like.[3] These features have a sclerotomal distribution and maybe monostotic, polyostotic or monomelic.[4] It was monomelic (one limb) in our patient. Melorheostosis presents in adulthood with a gradual onset of non-specific symptoms including pain and stiffness. When adjacent soft tissues are involved scleroderma-like skin changes, stiffness, deformity, and nerve compressive symptoms may manifest, as were present in our case above.[5]

Plain radiographs are sufficient for diagnosis. The differential diagnosis of infection or musculoskeletal neoplasm should be considered, and a biopsy is recommended if there is any doubt. Further imaging is generally of little value for diagnosis.[4] Magnetic resonance imaging (MRI) can be helpful to evaluate the soft tissues and to exclude other pathologies.[6] With nuclear medicine scans, the lesions have an increased uptake and hence is useful for surveillance and identifying lesions at various sites.[7] A link between the intensity of uptake and symptoms have yet to be established. Biochemical tests such as alkaline phosphatase and serum calcium levels are inconclusive but may serve in the work-up to exclude other pathology.[4]

There is no definite cure established for melorheostosis. Hence, there is no specific treatment and management is largely towards symptom relief. Multidisciplinary care from orthopaedic surgeons, metabolic bone and pain physicians are important in the long-term management for these patients. Non-operative options include analgesia, physiotherapy, and use of appropriate orthosis for immobilization. There are reports in the literature on use of bisphosphonates to decrease bone pain, as it reduces osteoclastic activity.[8] Surgical management poses a unique set of challenges as operations are performed on pathological bone. A variety of procedures have been described to relief symptoms such as, but not limited to nerve decompression, excision of fibrous tissue, debulking of exostosis, corrective osteotomy, and arthrodesis.[9]

We present a case of a rare pathology in our local setting, with no previous reports in literature on its prevalence in Australia. Knowing the global incidence, we extrapolate that there are potentially up to 24 cases per year, given the Australian population of 25 million.[10] It is also an example of the varying pathology that is prevalent in our local population, and more so Central Australia. We hope readers will have an increased awareness of this rare skeletal dysplasia and unique pathology in Australia. Early diagnosis and timely counselling of patient can avoid invasive diagnostic investigations and procedures. Misdiagnosis could lead to surgical treatment with bone debridement if mistaken for osteomyelitis. This could result in more harm instead of improving a patient's outcome.

DISCLOSURE STATEMENT

Nothing to disclose.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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