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Applied anatomy knowledge in gynaecology and obstetrics: the trainees' perception

Fida Asali[1*], Ismaiel Abu Mahfouz[2], Heba Abu Saleem[3], Salem Abu Mahfouz[4], Maha T. Mohammad[5] and Oqba Al-Kuran[6]

Abstract

Background: Medical education has recognised the importance of anatomy teaching. Limitations in applied anatomy knowledge exist among obstetrics and gynaecology (O&G) trainees.
This study aims to evaluate the knowledge of O&G trainees in applied anatomy and study-associated factors.

Materials and methods: The questionnaire-based study involved O&G trainees between 1/8/2019 and 1/12/2019. Data collected included age, gender, evaluation of medical school anatomy course, attendance at applied anatomy workshops, operating theatre workload, and senior colleagues' demonstration of anatomy during operating sessions.

Results: There were 271 trainees recruited with a mean age of 29.3 years, and 80.1% rated the value of medical school anatomy courses as average or above average. Furthermore, 90.8% never attended applied anatomy workshops. In addition, 9.6% and 62% of first- and fifth-year trainees rated their knowledge as either good or very good, and 41.7% reported that anatomy demonstrations by senior doctors happened sometimes. The overall score of applied anatomy knowledge was significantly higher in higher training years, with attendance at applied anatomy lectures, with more operating workloads, and when senior doctors demonstrate anatomy more often during operating sessions.

Conclusions: Deficiencies in knowledge existed. Factors which may improve knowledge include more applied undergraduate anatomy courses, more frequent operating sessions, attending anatomy workshops, and more senior colleagues' demonstration of anatomy during surgeries.

Keywords: Obstetrics, Gynaecology, Surgical anatomy, Medical students, Resident doctors, Trainees, Surgical education

Background

Medical education has recognised the importance of teaching anatomy to medical students and resident doctors in training [1]. While anatomy was fully covered for hundreds of years, it has currently been reduced in medical education curricula [2]. In addition, there has been a change from the traditional hands-on teaching on cadavers to using imaging such as ultrasound scans and magnetic resonance imaging, living anatomy, and multimedia resources [3]. Such a change in anatomy teaching has not been methodologically studied to see if it compromises patients' safety [4].

Toogood et al. [2] recognised a low unsafe level of teaching anatomy for medical students and suggested that more attention to anatomy education during residency training may bridge the knowledge gap. Applied anatomy knowledge is necessary for safe medical

* Correspondence: fidaasali@hu.edu.jo
[1]Department of Obstetrics and Gynaecology, Faculty of Medicine, The Hashemite University, Zarqa, Jordan
Full list of author information is available at the end of the article

practice, so there has been an increase in medical litigation attributed to the lack of appropriate knowledge in surgical anatomy [5].

Sgori et al. [6] evaluated trainees' perceptions of anatomical knowledge in obstetrics and gynaecology (O&G) training programmes and recognised limitations in applied anatomy knowledge among trainees at all levels. Therefore, they suggested formally applied anatomy courses during residency training. Furthermore, such limitations were also recognised among first year gynaecology oncology fellows, where 40% of fellows were not able to identify relevant anatomical structures during surgical operations [7].

The primary aim of our study was to evaluate the knowledge of O&G trainees in surgical anatomy in all five training years. Secondary aims included studying variables that could influence this knowledge such as age, gender, value of medical students' O&G anatomy courses, and attendance at formal applied anatomy lectures and workshops. In addition, monthly surgical procedures they attended or performed and how often senior colleagues demonstrate anatomy during operating theatre sessions were evaluated.

Methods

This was a cross-sectional questionnaire-based study involving trainees in O&G between 1 August 2019 and 1 December 2019. Inclusion criteria required the trainee doctor to be currently in a training programme.

The questionnaire was designed by the research team. Prior to approving the final version, face validity was established where Fellows and Members of the Royal College of Obstetricians and Gynaecologists (RCOG) in Jordan were invited to comment on the draft questionnaire, and their comments were considered. In addition, a group of 15 trainees in O&G in various training years were asked to review the questionnaire, and their comments were considered in the final version of the questionnaire which was used in the study. The questionnaire which included a list of 54 anatomical structures was distributed to various hospitals where there are O&G residency programmes, and the study was left open for 4 weeks (Table S 1). In addition, a reminder to take part in the study was sent to the various departments 14 days after the start of the study.

Data collected included age, gender, and overall surgical anatomy knowledge as rated by the trainees using a 5-point Likert scale (very poor, poor, average, good, and very good), along with if they ever attended formal surgical anatomy lectures or workshops and if they would like to attend a formal workshop. In addition, trainees were asked to evaluate medical school anatomy courses relevant to O&G training using a 5-point Likert scale (no value, limited value, average value, much value, and extreme value).

Moreover, trainees were asked about the average number of common O&G surgical procedures they assisted in or performed either independently or supervised every month. They were also asked to report the frequency of receiving demonstrations of surgical anatomy by senior colleagues during operating theatre sessions using a 5-point Likert scale (hardly ever, occasionally, sometimes, frequently, and almost always).

Trainees were finally asked to rate their knowledge in identifying the 54 anatomical structures during surgical operations that they perform or assist in. A 5-point Likert scale was used (very poor, poor, average, good, and very good).

The total number of O&G trainees in the various hospitals at the time of this research was 522. For a confidence level of 95% and confidence interval of 5, the sample size was calculated to be 222. Ethical approval was granted locally by the Institutional Review Board of the Specialty Hospital.

For normally distributed data, descriptive statistics were performed using mean ± SD, for non-normally distributed and Likert scale data using median and interquartile range, and for count data using frequencies and percentages. A total questionnaire score out of 270 was calculated by summing the responses of all the 54 anatomical structure questions.

The within-subjects t-test was used to compare the differences in total questionnaire scores between trainees based on gender, formal surgical anatomy lectures or workshops attended, and the number of surgical procedures they assisted in or performed independently every month.

One-way analysis of variance (ANOVA) was used to compare the differences in total questionnaire scores between trainees based on the year of their training, their rating of the value of medical school anatomy courses, and receiving demonstration of anatomical structures from senior colleagues during surgical operations. In case of significant differences, pot-hoc pairwise comparisons with Bonferroni corrections were done.

To compare the ability of the trainees to identify anatomical structures across the different years of training, a Kruskal-Wallis test was done with post hoc pairwise comparisons in case of significant differences.

The level of significance was set at $\alpha < 0.05$. Data were analysed using Statistical Package for Social Sciences for Windows (SPSS; Version 22, SPSS Inc., Chicago, Illinois).

Results

The questionnaire was completed by 271 trainees representing 51.9% of all O&G trainees in Jordan. Table 1

Table 1 Trainees' characteristics

Variable	Number (%)
Age	29.3 (3.0)
Gender	
Females	189 (69.7%)
Males	82 (30.3%)
Residency year	
First	52 (19.2%)
Second	50 (18.5%)
Third	60 (22.1%)
Fourth	51 (18.8%)
Fifth	58 (21.4%)
Value of medical school anatomy course to current training	
No value	4 (1.5%)
Limited value	50 (18.5%)
Average	147 (54.2%)
Much value	65 (24.0%)
Extreme value	5 (1.8%)
Attended formal anatomy lectures during residency	
Yes	119 (43.9%)
No	152 (56.1%)
Attended formal anatomy workshops during residency	
Yes	25 (9.2%)
No	246 (90.8%)
Senior colleague demonstrating structures during surgeries	
Hardly ever	22 (8.1%)
Occasionally	64 (23.6%)
Sometimes	113 (41.7%)
Frequently	67 (24.7%)
Almost always	4 (1.5%)

summarises the characteristics of the participants and their evaluations of medical school anatomy courses as relevant to O&G training, attendance at formally applied anatomy lectures or workshops, and how often senior colleagues demonstrated anatomical structures during surgical procedures.

The most common surgical procedures that trainees assisted in or performed every month are summarised in Table S2.

The average (SD) of the total questionnaire score for all trainees was 198.8 (39) and the scores ranged between 91 and 265. While 21.2% and 6.9% of first- and fifth-year trainees, respectively, rated their overall

Table 2 Overall applied anatomy knowledge distributed by year of training

Overall applied anatomy knowledge	Residency year					Total N (%)
	Year 1 N (%)	Year 2 N (%)	Year 3 N (%)	Year 4 N (%)	Year 5 N (%)	
Very poor	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.7)	1 (0.4)
Poor	11 (21.2)	6 (12)	2 (3.3)	3 (5.9)	3 (5.2)	25 (9.2)
Average	36 (69.2)	36 (72)	32 (53.4)	23 (45.1)	18 (31.1)	145 (53.5)
Good	5 (9.6)	6 (12)	24 (40)	23 (45.1)	30 (51.7)	88 (32.5)
Very good	0 (0)	2 (4)	2 (3.3)	2 (3.9)	6 (10.3)	12 (4.4)
Total	52 (100)	50 (100)	60 (100)	51 (100)	58 (100)	271 (100)

anatomy knowledge as either very poor or poor, 9.6% and 62% of first- and fifth-year trainees, respectively, rated their knowledge as either good or very good (Table 2).

Data analysis showed no significant differences in total questionnaire scores between female and male trainees (p = 0.37).

The results showed that there were significant differences in total questionnaire scores across the years of the training programme ($p < .001$). Pairwise comparisons revealed significant differences between first- and third-year trainees along with fourth and fifth years (all ps < 0.001). Similarly, there were significant differences between second-year trainees and third, fourth, and fifth years (all ps < 0.001). Figure 1 shows the averages of the total questionnaire scores for all 5 years of the training programme.

When the abilities of the trainees to identify individual anatomical structures were compared across the 5 years of the training programme, there were significant differences in all structures (all ps < 0.05) except for normal breast anatomy (p = 0.09). The most frequent significant pairwise comparisons in the ability to identify anatomical structures were between first and fifth years (in 92.5% of the structures), followed by first and fourth years (in 84.9% of the structures), second and fifth years (in 77.4% of the structures), first and third years (73.6%), second and fourth (66%), and lastly second and third years (43.4%) as seen in Table Ss3.

There were significant differences in total questionnaire scores between trainees based on their rating of the value of a medical school anatomy courses (p = 0.002). Pairwise comparisons revealed that the total questionnaire scores for trainees who viewed a course as helpful were significantly higher than those who viewed a course of limited value (p = 0.003).

Total scores for trainees who attended anatomy lectures were significantly higher than those who did not (p = 0.006). In addition, there were no significant differences in total questionnaire scores between trainees who attended formal anatomy workshops during their training and those who did not (p = 0.058).

Total questionnaire scores were compared between trainees based on the average numbers of different surgical procedures they attended or performed every month. We compared the scores based on whether the trainees attended the procedures or not in a month. The results showed significant differences in all surgical procedures except instrumental deliveries and sub-urethral tapes.

There were significant differences in total questionnaire scores between trainees based on how often they received demonstrations of surgical anatomy structures from senior colleagues ($p < 0.001$). Pairwise comparisons revealed that the total scores for trainees who received

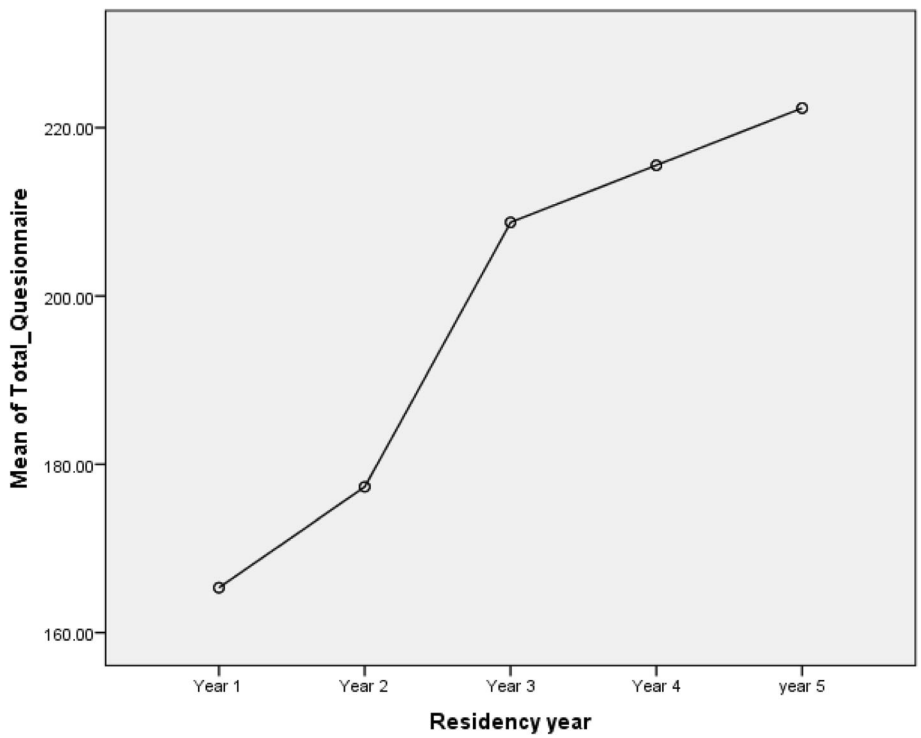

Fig. 1 Average of total questionnaire scores for all the 5 years of the residency programme. There were significant differences between first year and third, fourth, and fifth years as well as between second year and third, fourth, and fifth years (ps < 0.001)

demonstrations frequently were significantly higher than those who received the demonstrations hardly ever ($p < 0.001$), occasionally ($p < 0.001$), and sometimes ($p < 0.018$). Figure 2 shows the averages of the total questionnaire scores based on the frequency of receiving demonstrations during surgeries.

Discussion

The response rate which was 51.9% reflects a moderate rate which is in keeping with a published report about response rates in questionnaire-based medical research [8].

The value of medical school anatomy courses as relevant to O&G was rated as average or above average by over 80% of the recruited trainees in our study. This reflects the importance of undergraduate anatomy education. Surgical anatomy knowledge among medical students who started their clinical surgical training in O&G was reviewed by Jurjus et al. [9]. Their results showed that medical students' knowledge was poor in abdominal cavity, pelvic organs, urogenital development, and pregnancy. In addition, another report [10] showed that 92% of trainees in O&G were not satisfied with the anatomy knowledge they gained during their undergraduate medical education. The differences between our results and the published report may be due to differences in anatomy teaching methods.

Our results showed that 56.1% and 90.8% of trainees never attended an applied anatomy lecture or workshop, respectively. Furthermore, there was a statistically significant difference in total questionnaire scores between trainees who attended formal anatomy lectures during their training years and those who did not. However, this was not the same between trainees who attended formal anatomy workshops and those who did not. This probably is related to the small number of trainees who have ever attended a formal anatomy workshop. A randomised controlled trial [11] showed that trainee's attendance at structured pelvic anatomy reviews using cadaveric dissection was associated with better performance in both written and practical examinations of pelvic anatomy. In addition, participants in a postgraduate surgical skills training programme of the Flemish Society of Obstetrics and Gynaecology reported that the hands-on cadaver workshop was helpful for clinical practice and helped in improving anatomy knowledge and laparoscopic surgical skills of trainees [12]. The minimally invasive surgical training of the Dutch Obstetrics and Gynaecology residency curriculum required resident doctors to attend a basic surgical skills course followed by further surgical training on simulators [13]. This

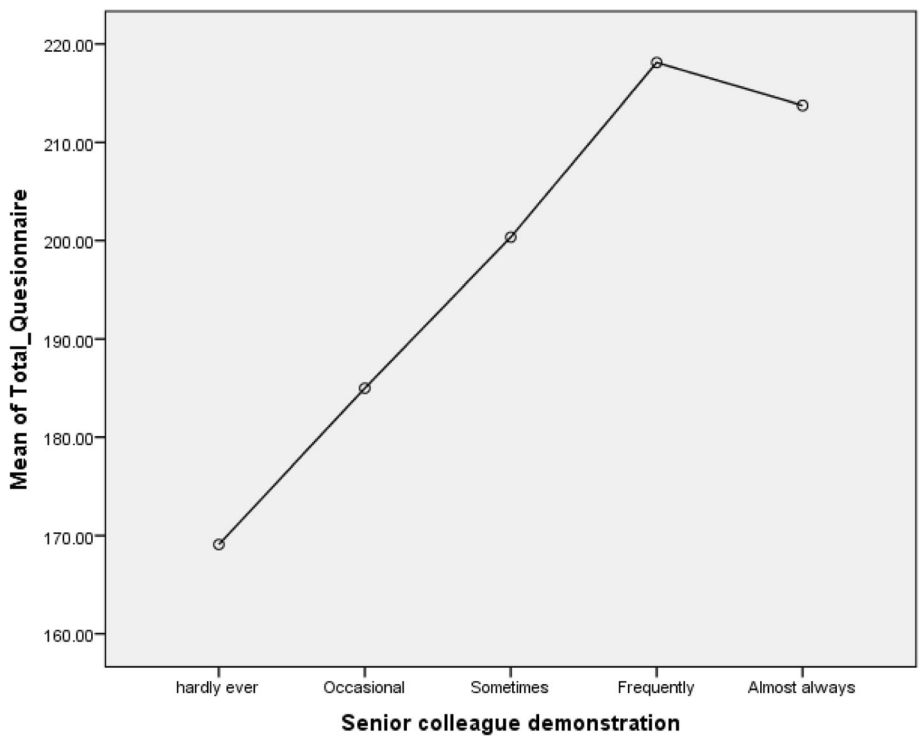

Fig. 2 Average of total questionnaire scores based on frequency of receiving demonstration of anatomical structures from senior colleague during surgeries. There were significant differences between trainees who received demonstrations frequently and hardly ever, occasionally, and sometimes, and between trainees who received demonstration sometimes and hardly ever (ps < 0.005)

demonstrated the importance of formal applied anatomy courses and workshops in O&G training.

Over 87% of the trainees in our study expressed an interest in attending formal surgical anatomy training. If, however, such workshops are not available, other teaching modalities may be implemented and were shown to be of value. A multicenter, randomised controlled trial reported a significant improvement in laparoscopic hysterectomy skills of O&G trainees after using the Laparoscopic Hysterectomy Trainer [14]. Another method is joining clay modelling with lectures which was shown to be an effective method of teaching female pelvic anatomy for trainees [15].

While 21.2% and 6.9% of first-year and fifth-year trainees, respectively, rated their overall anatomy knowledge as either very poor or poor, 9.6% of first-year trainees and 62% of fifth-year rated their knowledge as either good or very good. Similar trends in overall surgical anatomy knowledge were shown by Sgroi et al. [6] where 11% of O&G resident doctors reported their surgical anatomical knowledge as adequate at the beginning of training, and 77% reported adequate knowledge by the final year of training. In addition, final year residents were more able to identify structures compared to first-year residents. Furthermore, a survey of gynaecology oncologists involved in fellowship training in the USA reported that 40 % of their new fellows could not recognise anatomy and tissue planes [7]. Both reports showed deficiencies of surgical anatomy knowledge at different levels of O&G training.

The results of our study showed that trainees who attended and/or performed surgical procedures more often rated their surgical anatomy knowledge higher. Another report showed that the surgical anatomy knowledge of resident doctors was related to the number of procedures they performed as primary surgeons [6].

In our study, 41.7% and 24.7% of the trainees reported that senior colleagues demonstrate anatomy sometimes and frequently, respectively. This reflects a deficiency in operating theatre teaching sessions. Trainees learn anatomy through self-guided reading and direct experiences in the operating theatre [16]. Furthermore, the Wood et al.'s study [17] that involved trainees and specialists reviewed the unmet operative learning requirements and trainee's ability to perform surgery in O&G. Their results showed that trainees relied on "advice from colleagues" as an essential learning resource. In addition, 75% of specialists reported surgical anatomy as the most common unmet resident learning need. While specialty training programmes are designed by specialists' gynaecologists and educators, they should consider the opinions of the trainees. The European Board and College of Obstetrics and Gynaecology initiated a new training curriculum in O&G to ensure comparable training across Europe and achieve the highest possible standards of training to improve healthcare. Obstetrics and gynaecology trainees across Europe were involved in the initiative from the beginning and supported it [18]. Furthermore, the European curriculum is based on the latest medical educational methodology and provides strategies for assessment through training as well as strategies for faculty development and training quality management [19]. The results of our study and similar studies may be considered in establishing standards of surgical anatomy knowledge.

An earlier report showed that 92% of residents were not satisfied with the anatomy knowledge they gained during undergraduate medical training [10]. In addition, medical students described a lack of visualisation as a barrier to theatre-based learning [20]. This reflects a teaching deficiency at different levels of medical education which should be addressed to improve knowledge and skills.

Complications may result from the proximity of the gynaecological organs to the urinary tract, bowel, nerves, and vasculature. A 3.8% overall prevalence rate of complications for gynaecological surgery was reported; 1.8% were major and 2% were minor complications [21]. To perform safe surgery, O&G doctors should have adequate surgical anatomy knowledge particularly in situations where anatomy is distorted by adhesions or surgical bleeding [22].

Surgical skills are usually passed from senior to junior doctors during operating theatre sessions. While the presence of trainees in the operating theatre with the specialists was associated with an increased risk of blood transfusion and longer operating time, their presence was not associated with increased risk of injuries to adjacent organs or unplanned reoperations [23]. Additionally, the readiness of trainees in performing surgical procedures and the supervising specialists' perception of the trainees' readiness should be carefully considered during surgical operations. Carugno et al. [24] assessed the self-reported readiness of US O&G trainees and the perception of the programme directors in the readiness of trainees in performing various surgical procedures. Their results showed 90% of the trainees and their programme directors were confident in the trainees' abilities to perform operative hysteroscopy, and 63% of postgraduate year one and 92% of year two felt they could perform an operative hysteroscopy independently. This reflects limitations in both the perception of the trainees' readiness and the trainers' ability to assess competencies in high-risk surgical operations. Additionally, operating sessions are not enough for training. Therefore, residents may consider attending applied anatomy workshops [25] which may be used for trainees' evaluation.

Obstetrics and gynaecology trainees should have education in applied anatomy throughout their training programme. In addition, introducing modern teaching media such as anatomy videos may improve their anatomical knowledge [10]. Sartori et al. [26] evaluated the learning climate (LC) and the quality of training in postgraduate training courses in O&G in Italy and concluded that training improvement is required through formal teaching and specialty tutors to ensure training with a better LC 26.

We acknowledge the limitations of our study; the method used for evaluating surgical anatomy knowledge was subjective and we included anatomical structures which probably are not of high significance to O&G trainees.

Conclusions

We identified deficiencies in surgical anatomy knowledge among trainees in all training years. In addition, the results identified various factors which may improve knowledge such as more applied undergraduate anatomy courses, more frequent operating theatre sessions, attending formal anatomy work, and more senior colleagues' demonstration of surgical anatomy during theatre sessions.

Abbreviations

O&G: Obstetrics and gynaecology

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s10397-021-01092-9.

Additional file 1:. Supplementary tables

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Authors' contributions

The manuscript has been read and approved by all authors. In addition, all authors contributed to the preparation of the manuscript. IAM, FA, and OK conceived and designed the study and then drafted and edited the manuscript. HS and SM undertook data collection and data entry, prepared tables and figures, and edited the manuscript. MM revised the methods, performed statistical analysis, and edited the manuscript. IAM supervised all aspects of the study.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Specialty Hospital (IRB 99289/5/1/ت). All authors declare that this study is an original project and has not been published elsewhere.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

Author details

[1]Department of Obstetrics and Gynaecology, Faculty of Medicine, The Hashemite University, Zarqa, Jordan. [2]Department of Obstetrics and Gynaecology, Faculty of Medicine, Al Balqa Applied University, Al Salt, Jordan. [3]Department of Obstetrics and Gynaecology, Specialty Hospital, Amman, Jordan. [4]Faculty of Medicine, The Hashemite University, Zarqa, Jordan. [5]School of Rehabilitation Sciences, University of Jordan, Amman, Jordan. [6]Department of Obstetrics and Gynaecology, School of Medicine, The University of Jordan, Amman, Jordan.

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