

Trainee's Perception Of Applied Anatomy Knowledge in Obstetrics and Gynaecology: A prospective cross-sectional study

Ismail Abu Mahfouz¹, Fida Asali², Heba Abu Saleem³, Maha Mohammad⁴, Salem Abu Mahfouz⁵, and Oqba Al-Kuran⁴

¹Al-Balqa' Applied University

²The Hashemite University Faculty of Medicine

³The Specialty Hospital

⁴The University of Jordan

⁵The Hashemite University

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Abstract

Abstract Objective Evaluate Obstetrics and Gynaecology (O&G) trainees' knowledge in surgical anatomy **Designs** Prospective cross-sectional study. **Setting** Departments of O&G in various hospitals **Population** Trainees in O&G recruited between 1st August to 1 December 2019 **Method:** Hard copy questionnaire based study. Information regarding demographics such as gender, year of training, attendance at applied anatomy workshop. In addition, perception of surgical anatomy knowledge was recorded. **Main outcome measures** Perception of surgical anatomy knowledge among trainees **Results** We recruited 271 trainees, mean age 29.3 years, and 80.1% rated value of medical school course as average or above. In addition, 90.8% never attended anatomy workshop, and 9.6% and 62% of first and fifth year residents respectively rated their knowledge as either good or very good, and 41.7% reported that anatomy demonstrations by senior doctors happened sometimes. Perception of knowledge was statistically significantly more in higher training years, higher perceived value in medical school course, attendance at anatomy lectures, more operating experience, and when senior doctors demonstrate anatomy more often. **Conclusion** Deficiencies were identified in surgical anatomy knowledge among resident in all years. Factors identified which may improve knowledge include more applied undergraduate anatomy courses, more operating sessions and anatomy workshops, and more senior colleagues' demonstration of surgical anatomy. Overall knowledge in regards to anatomy needs to be improved for better patient safety. **Keywords:** obstetrics, gynaecology, surgical anatomy, medical students, resident doctors **Tweetable abstract** Do Obstetrics and Gynaecology trainees have adequate surgical anatomy knowledge? **Funding:** No funding was required for this study

Tweetable abstract

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Introduction

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, currently it has been reduced

in medical education curriculums². In addition, there has been a change from the traditional "hands-on" teaching on cadavers to using imaging such ultrasound scans and magnetic resonance imaging, living anatomy, and multimedia resources³. Such a change in anatomy teaching has not been methodologically studied to see if it compromises patient safety⁴.

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. While applied anatomy knowledge is necessary for safe medical practice, there has been an increase in medical litigation attributed to the lack of appropriate knowledge in surgical anatomy⁵.

Several reports in obstetrics and gynaecology (O&G) discussed the importance of applied anatomy education during postgraduate training. Sgori et al.⁶ evaluated trainees' perceptions of the level of anatomical knowledge in O&G training programs and recognised limitations in applied anatomy knowledge among trainees at all levels of training. In addition, they suggested formal 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 operations⁷. Such a report from a fellowship program further emphasized the perception of inadequate knowledge in surgical anatomy during residency training.

There are several abdominal, pelvic, and perineal anatomical structures relevant to O&G that resident doctors are expected to have appropriate knowledge about.

The primary aim of our study was to evaluate O&G resident doctors' knowledge in surgical anatomy in all the five training years. Secondary aims included studying variables that could influence this knowledge such as age, gender, value of medical student O&G anatomy course, 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 study was a prospective cross-sectional questionnaire-based study involving resident doctors in O&G between 1st August 2019 and 1st December 2019. Inclusion criteria required the resident doctor to be currently in a training program and willing to take part in the study.

The questionnaire was designed by the research team with modification based on a previously published report⁶. Prior to approving the final version, face validity was established where 38 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 resident doctors in O&G in various training years were asked to review the questionnaire, and their comments were also 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 the various hospitals where there are O&G residency programs and the study was left open for four weeks. In addition, resident doctors were invited to take part in the study where participation was voluntary and personal identification data were not collected. Furthermore, a reminder to take part in the study was sent to the various departments fourteen days after the start of the study.

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

Moreover, resident doctors 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 five-point Likert scale (hardly ever, occasionally, sometimes, frequently, and almost always).

Resident doctors were finally asked to rate their knowledge about the defined 54 anatomical structures on a five-point Likert scale (very poor, poor, average, good, and very good). The anatomical structures are shown in Table S 1.

Sample Size Calculation

The study population included resident doctors in O&G currently in the training programs in both public and private hospitals. Formal information was obtained from the various training programs and showed that the total number of O&B residents in the various hospitals at the time of running the 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.

Statistical Analysis

Descriptive statistics were performed for normally-distributed data using mean \pm 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.

Within-subjects t-test was used to compare differences in total questionnaire scores between resident doctors based on gender, formal surgical anatomy lectures or workshops attended during residency training, and the number of surgical procedures they attended or performed every month.

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

To compare the ability of residents to identify anatomical structures across the different years of the residency, 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 analyzed using SPSS for Windows (Version 22, SPSS Inc., Chicago, Illinois).

Results

Data Analysis: General

The questionnaire was completed by 271 resident doctors representing 51.9% of all residents in Jordan. Of those, there were 189 (69.7%) females and 82 (30.3%) males. The average (SD) for age was 29.3 (3.0) years. During their residency program, while the majority of the residents never attended formal applied anatomy lectures ($n = 152$; 56.1%) or workshops ($n = 246$; 90.8%), 236 (87.1%) expressed their interest in attending future workshops.

In addition, 147 (54.2%) residents reported that the value of a medical school anatomy course was average, and 217 (80.1%) rated the value between average and extremely valuable for their current O&G training. When asked how often senior colleagues demonstrated anatomical structures during surgical procedures, 113 (41.7%) residents responded that this happened sometimes and 71 (26.2%) residents responded that this happened often. Table 1 summarizes the demographics of the respondents.

The surgical procedures that were most commonly attended or performed by resident doctors every month were caesarian section, vaginal delivery, and episiotomy repair with a median number of attended procedures per month at 15, 20, and 10, respectively. For all other procedures, the number of residents who did not attend or perform any per month ranged between 102 (for ovarian cystectomy) to 214 (for vaginal vault

repair). Table S2 shows a summary of procedures attended or performed by resident doctors every month grouped according to the year of training.

The average (SD) of the total questionnaire score for all residents was 198.8 (39) and the scores ranged between 91 and 265. Furthermore, 21.2% and 9.6% of first and fifth year residents, respectively, rated their overall anatomy knowledge as either very poor or poor while 9.6% and 62% of first and fifth year residents, respectively, rated their knowledge as either good or very good (Table 2).

Data Analysis: Total Questionnaire Scores for Surgical Anatomy Knowledge and Various Variables

Data analysis showed no significant differences in total questionnaire scores between female (197.4 ± 38.8) and male residents (202 ± 39.7) with $t(269) = 0.898$ and $p = 0.37$.

The results also showed that there were significant differences in total questionnaire scores across the years of the residency program ($F[4, 266] = 31.9, p < .001$). Pairwise comparisons revealed significant differences between first year residents (165.3 ± 39.1) and third (208.7 ± 33.0) along with fourth (215.5 ± 26.1) and fifth years (222.3 ± 30.6); all $ps < 0.001$. Similarly, there were significant differences between second year residents (177.3 ± 31.6) and third, fourth, and fifth years; all $ps < 0.001$. Figure 1 shows the averages of the total questionnaire scores for all five years of the residency program.

When the residents' ability to identify individual anatomical structures were compared across the five years of the residency program, there were significant differences in all structures (all $ps < 0.05$) except the 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 S 3.

There were significant differences in total questionnaire scores between residents based on their rating of the value of a medical school anatomy course ($F[4, 266] = 4.23, p = 0.002$). Pairwise comparisons revealed that the total questionnaire scores for residents who viewed the course as helpful (212.6 ± 34.4) were significantly higher than those for residents who viewed the course of limited value ($186.3 \pm 40.5, p = 0.003$). Figure S 1 shows the averages of the total questionnaire scores based on the residents' ratings of the value of a medical school anatomy course.

Data analysis showed a statistically significant difference in total questionnaire scores between residents who attended formal anatomy lectures during their residency and those who did not with $t(266) = 2.78$ and $p = 0.006$. Total scores for residents who attended anatomy lectures (206 ± 35.6) were significantly higher than those who did not (193.1 ± 40.8). On the other hand, there were no significant differences in total questionnaire scores between residents who attended a formal anatomy workshops during their residency (212.9 ± 36.7) and those who did not (197.4 ± 39.1) with $t(269) = 1.906$ and $p = 0.058$.

Total questionnaire scores were compared between residents based on the average numbers of different surgical procedures they attended or performed every month. For this purpose, we performed two comparisons. In the first, we compared total questionnaire score with the procedures that were commonly attended by residents where we examined the differences at each year between residents who attended the surgeries more often ([?] median) and those who attended less often ($<$ median). The results showed significant differences in total questionnaire scores between residents in second year for the vaginal delivery, third year for all three surgeries, and fourth year for repair of episiotomy (Table S 4) . In the second comparison, we compared the scores based on whether the resident attended the procedures or not in a month. The results showed significant differences in total questionnaire scores in all surgeries except instrumental deliveries and sub-urethral tapes (Table S 5).

There were significant differences in total questionnaire scores between residents based on how often they received demonstrations of surgical anatomy structures from senior colleagues during surgical operations ($F[4, 265] = 10.8, p < 0.001$). Pairwise comparisons revealed that total scores for residents who received

demonstrations frequently (218.1 \pm 28.9) were significantly higher than those who received the demonstrations hardly ever (169.1 \pm 36.8, $p < 0.001$), occasionally (185 \pm 40.6, $p < 0.001$), and sometimes (200.3 \pm 38.4, $p < 0.018$). Also, total scores for residents who received demonstrations sometimes were significantly higher than those who received the demonstrations hardly ever ($p = 0.003$). Figure 2 shows the averages of the total questionnaire scores based on the frequency of receiving demonstrations during surgeries.

Discussion

Main finding

There were 271 residents who completed the questionnaire with the response rate of 51.9%. The mean age was 29.3 years and 69.7% were females. In addition, 54.2% of residents reported that the value of medical school anatomy courses was average, and 80.1% rated the value of these courses as average or above average. Furthermore, 56.1% and 90.8% of residents never attended a formal applied anatomy lecture or workshop, respectively. In addition, 21.1% and 51.7% of first and fifth year residents rated their overall anatomy knowledge as good, respectively, and 41.7% reported that anatomy demonstrations by senior doctors happened sometimes. Furthermore, the overall score of surgical anatomy knowledge was significantly higher for residents in the higher training year, and for residents who perceived value in medical school anatomy courses, attended or performed more surgical procedures, attended formal applied anatomy lectures, and who witnessed senior doctors demonstrating anatomy more often during operating theatre sessions.

Interpretation of results

The response rate which was 51.9% reflects a moderate rate which is in keeping with a published report about the response rate in questionnaire based medical research⁸. Not achieving a higher response rate is probably related to the wide geographical distribution of public hospitals and the difficulty in reaching all training sites for logistic reasons.

The value of medical school anatomy courses as relevant to O&G was rated as average or above average by over 80% of residents 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 report¹⁰ 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 residents never attended a formal applied anatomy lecture or workshop, respectively. Furthermore, there was a statistically significant difference in total questionnaire scores between residents who attended formal anatomy lectures during their residency training and those who did not but not between residents who attended formal anatomy workshops and those who did not. This probably is related to the small number of residents who ever attended a formal anatomy workshop. A randomized controlled trial¹¹ showed that resident doctors' 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 program of the Flemish Society of Obstetrics and Gynaecology reported that the hands-on cadaver workshop was helpful for both clinical practice and also helped in improving their anatomy knowledge and laparoscopic surgical skills¹². 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 simulators¹³. This reflects the importance of formal applied anatomy courses and workshops in O&G training.

Over 87% of the residents 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 was shown to be of value. A multicenter, randomized controlled trial reported significant improvement in laparoscopic hysterectomy skills of O&G residents after using the Laparoscopic Hysterectomy Trainer¹⁴. Another method

is joining clay modeling with lectures which was shown to be an effective method of teaching female pelvic anatomy and abdominal hysterectomy procedure for junior residents¹⁵.

While 21.2% and 6.9% of first and fifth year residents rated their overall anatomy knowledge as either very poor or poor, 9.6% and 62% 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 while 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 United States reported that 40 % of their new fellows could not recognize anatomy and tissue planes⁷. Both reports reflected deficiencies of surgical anatomy knowledge at different levels of O&G training.

The results of our study showed that residents who attended and/or performed surgical procedures more often rated their surgical anatomy knowledge higher. Another report showed that resident doctors' surgical anatomy knowledge was related to the number of procedures they performed as primary surgeons⁶.

Our results showed that 41.7% and 24.7% of resident doctors reported that senior colleagues demonstrate anatomy sometimes and frequently, respectively. This reflects a deficiency in operating theatre teaching sessions. In most training programs, trainees learn anatomy through self-guided reading and direct experiences in the operating theatre¹⁶. Furthermore, in the Wood et al. study¹⁷ that involved residents and specialists, they reviewed the unmet operative learning requirements and resident doctors' ability to perform surgery in O&G. Their results showed that residents 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. An earlier report showed that 92% of residents were not satisfied with the anatomy knowledge they gained during undergraduate medical training¹⁰. In addition, medical students described a lack of visualization as a barrier to theatre based learning¹⁸. 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 while 1.8% were major and 2% were minor complications¹⁹. To perform safe surgery, O&G doctors should have adequate surgical anatomy knowledge particularly in situations where anatomy is distorted by adhesions or surgical bleeding²⁰.

Surgical skills are usually passed from senior to junior doctors during operating theatre sessions. While the presence of residents 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 reoperations²¹. Another report showed that specialists' involvement in the operating theatre sessions was associated with reduced morbidity and mortality²². However, operating sessions are not enough. Resident doctors may consider attending formal applied anatomy workshops which were perceived by residents as important²³.

Strengths and limitation

The main strengths our study or are the moderate response rate, the representative sample which covered most training sites in Jordan. In addition, we included all the five training years. Furthermore, the variable that we studied covered various factors which may affect the perception of surgical anatomy knowledge, and the results showed a significant association between there factors and the rating of knowledge in surgical anatomy. We acknowledge the limitations of our study; the method that we used for evaluating surgical anatomy knowledge was subjective, we included surgical structure which probably are not of high significance to obstetrics and gynaecology, in addition, we did not include structures such as nerves

Interpretation and recommendations

Obstetrics and gynaecology residents should have education in applied anatomy throughout their train-

ing program. In addition, introducing modern teaching media such as anatomy videos may improve the anatomical knowledge gained through books, lectures, and cadaveric dissections¹⁰. Furthermore, emphasis on anatomic education in the residency programs will help prepare the next generation of pelvic surgeons to face the challenges of modern medicine ²⁴.

Further research is suggested where specialist may objectively evaluate trainee's knowledge in surgical anatomy while operating and across all the training years; This may provide more information about anatomy knowledge among trainees and also identify areas for improvement through establishing core training program in surgical anatomy relevant to each training years

Conclusion

Our results identified deficiencies in surgical anatomy knowledge among resident doctors in all residency years. In addition, the results identified various factors which may improve knowledge such as more applied undergraduate anatomy course, more frequent operating theatre sessions, attending at formal anatomy work and more senior colleagues' demonstration of surgical anatomy during theatre sessions. Improve overall knowledge that will be reflected on patient's safety

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Disclosure of interest:

The authors declare no conflict of interest

Contribution to authorship

The manuscript has been read and approved by all authors. In addition, all authors contributed to the preparation of the manuscript. I A, F A and O K conceived and deigned he study, drafted and edited the manuscript. H A and S A undertook data collection, data entry, prepared tables and figures and edited the manuscript. T M revised the methods, performed statistical analysis and edited the manuscript. I A supervised all aspects of the study

Ethical approval details

Ethical approval was granted by the Institutional Review Board of the Specialty Hospital

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Supporting information

Additional supporting information may be found on line in the Supporting Information Section at the end of the article

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