

DESCRIPTIVE SURVEY

Is it time for anatomists to enter the OT? Their role in clinical anatomy education of residents: A pre-trial survey research among surgeons

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ABSTRACT

OBJECTIVE: This study aimed to assess the perceived need among surgical residents to revisit their anatomical knowledge and evaluate their attitude towards integrating clinical anatomists into surgical residency program curriculum.

BACKGROUND: While medical students learn human anatomy during undergraduate years, the practical application of clinically oriented anatomy becomes vital in surgical specialties. However, this aspect has not been adequately addressed in Indian surgical residency programs.

METHODS: An 11-item questionnaire, including closed-ended and Likert-scale questions, was administered to 153 surgical residents. Consent was obtained, and responses were collected via Google Forms.

RESULTS: Half of the respondents (50%) felt confident in their self-directed anatomy learning, but 87% believed integrating clinical anatomists would enhance their surgical expertise. Additionally, 88% saw value in revisiting cadaveric dissection. Third-year residents showed a significantly higher inclination towards cadaveric dissection. Deficiencies in the curriculum and time constraints were identified as major barriers.

CONCLUSION: The study highlights a perceived need among surgical residents to augment their anatomical knowledge, advocating for the integration of clinical anatomists and cadaveric dissection into training.

A collaborative approach, emphasizing both horizontal and vertical integration of anatomy, is recommended to enhance surgical education and practice. (*Tab. 4, Fig. 1, Ref. 25*). Text in PDF www.elis.sk

KEY WORDS: anatomist, clinical anatomy, postgraduate curriculum, surgical resident, survey.

Introduction

In the preface to the first edition of Gray's Anatomy, Henry Gray wrote that "This Work is intended to furnish the student and practitioner with an accurate view of the anatomy of the Human Body, and more especially the application of this science to practical surgery" (1).

A medical graduate learns the majority of human anatomy when they are in their first year of under graduation. The main implementation of evidence-based and clinically-oriented anatomy teaching comes during the periods of clinical exposure for undergraduates and, more importantly, when the doctors enter surgical specialties. By this time, knowledge of anatomy, a highly volatile subject, might not be that vivid as it was learnt during first year

in the medical school. Poor retention of anatomical knowledge has been reported in the literature (2, 3). The National Medical Council of India has brought out the latest competency-based medical education (CBME) curriculum in 2017, which also identifies this issue. To emphasize the reinforcement of basic science knowledge, the concept of horizontal and vertical integration has been recently introduced in the undergraduate curriculum(4). Amidst the varied logistic and socio-cultural challenges across the globe in implementation of CBME program in postgraduate medical education, an extensive inter-departmental collaboration is advocated to bridge the gaps in knowledge and ideas in order to formulate a fruitful structured programme (5–7). The impact of clinical anatomy knowledge learnt during first year of medical school is something that is worth revising not only during post-graduation, but during the entire lifetime of any clinician.

Deficits in anatomic knowledge and experience of medical students entering surgical training programs have long been recognized (8). Clinically oriented anatomical knowledge forms the basis of surgical skill development and is very essential in the diagnosis and management of surgical illnesses (9). Surgical trainees find it very challenging if they do not have detailed anatomical knowledge. This hinders the development of their surgical skills,

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as much of it is based on their ability to identify the structures accurately during the surgeries (10). Moreover, surgeons must have a good knowledge of the anatomical variations which they are likely to encounter to avoid inadvertent damage to structures and hence more chances of surgical complications. In many institutes, the need for reinforcement of anatomical knowledge has been addressed by implementing short refresher courses, cadaveric courses, or extensive problem-based courses. Their results have shown very promising improvements in the anatomical knowledge and, simultaneously, confidence in the skill development of the residents (10–12). Anatomy is best learnt in the context of surgical training (13). Such a need has never been addressed in the surgical residency programs conducted in India. The postgraduate surgical curriculum does not have any incorporation of anatomy courses. We propose to conduct a short-term anatomy refresher course as an integrated approach in a phased manner, where the surgical residents will be trained in relevant anatomy based on the surgeries being performed. In this context, the present survey was conducted to identify whether the surgical residents felt the need to revisit their anatomy knowledge. This survey aimed at collecting baseline data from the surgical residents to gain information and insights regarding their requirements before conducting a targeted clinical anatomy refresher course. This opportunity was also used to assess their need for an anatomist before and during the surgical procedures. We also tried to identify the major hindering factors for such anatomy refresher courses and also gathered their inputs on the various areas in which in-depth anatomical knowledge was required.

Materials and methods

This study was conducted among the surgical residents of two tertiary patient care teaching institutes with research centers located in New Delhi, India. An 11-item questionnaire was designed following a thorough literature search on current attitudes and knowledge of clinical anatomy among surgeons. The study was exempted from ethical approval by the institutional ethics committee. A pilot test was then conducted on a small sample of intended respondents. Suggestions for possible improvements were considered and further revisions were made in the questionnaire. Content validation was done by thorough analysis of the questionnaire by two subject experts.

The questionnaire was administered through Google forms after obtaining informed voluntary consent from the participants. The first part of the questionnaire described the purpose of the assessment. The second part contained details of the participants, like the name of their surgical specialty and the year of residency. This was followed by 9 questions designed to understand their opinion about their clinical anatomy knowledge and the need for clinical anatomists inside and outside the operation theatre for an in-depth knowledge of clinically oriented anatomy. The first one was a dichotomous (yes/no) question followed by 5-point Likert-type questions, ranging from strongly disagree to strongly agree. Two open-ended text responses were also collected and underwent thematic analysis to categorize the responses.

Statistical analysis

The participants' opinions on various items in the questionnaire were summarized and described as number and percentage for dichotomous variables and median and interquartile range (IQR) for the Likert scale variables. All the decimals were rounded off to their nearest tenths or nearest whole numbers. In order to test if there is any difference between the opinions of freshmen residents and seniors, we compared the responses of surgical residents' year-1 & 2 with surgical residents' year 3 using the Wilcoxon rank-sum test for the Likert score variables and the chi-square test for dichotomous variables. An inductive qualitative approach was employed to analyze the overall open-ended questions via open coding and identification of emergent themes.

Results

We received a total of 153 responses from the surgical residents of various sub-specialties. The departmental profile of the residents is mentioned in Figure 1. Among the participants, 35 (23%) were first-year residents, 22 (14%) were second-year and 96 (63%) were third-year surgical residents. The questionnaire administered to the participants was broadly divided into three groups. The first three questions were asked to understand the attitude of the

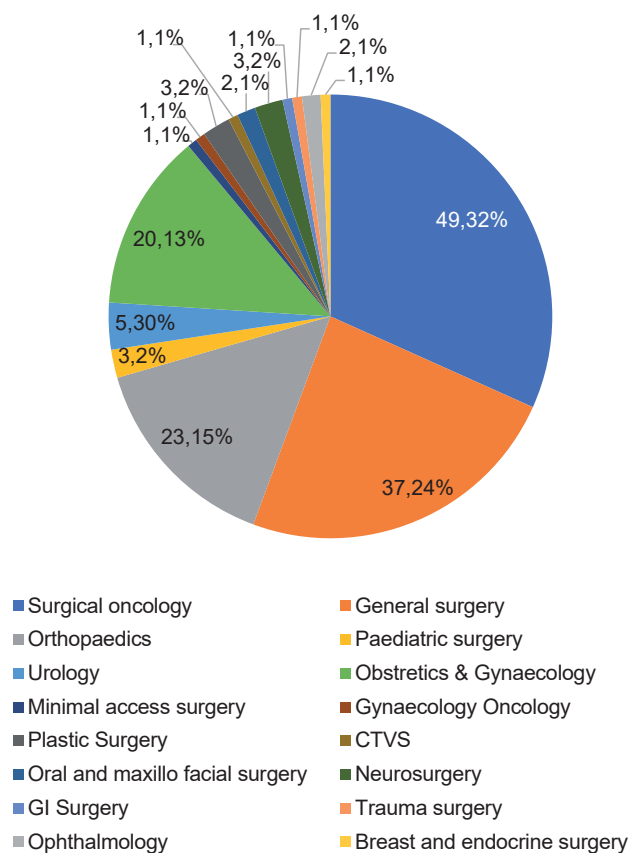


Fig. 1. Surgical specialty of survey participants (pie chart showing number of participants in each surgical specialty followed by percentage).

surgical residents regarding their current knowledge of anatomy for surgical practice (Tab. 1).

1) Without the knowledge of detailed anatomy, doing surgery is like travelling through an uncharted sea. Do you agree with this statement?

This was a dichotomous scale response question where the participants had to answer yes or no. 151 (99%) of the participants answered yes as a response.

2) Do you believe you have adequate knowledge of regional anatomy in relation to the surgeries performed as a surgical resident?

The participants had to respond to a five-point, Likert- scale questionnaire from strongly disagree to strongly agree. The observed median was 2 (Inter quartile range (IQR) 2–3). Cumulative responses, which included agree and strongly agree, found that 63% of the participants opined they had sufficient regional anatomy knowledge. Twenty-nine (19%) participants gave a neutral response. While 28 (18.3%) of the respondents reflected that their regional anatomy knowledge was not adequate.

3) Is self-directed learning (books and internet sources) along with senior surgeons teaching anatomy in operating rooms enough to thoroughly prepare you for performing or assisting surgeries?

50% of those polled agreed or strongly agreed. Twenty-eight (18%) participants gave a neutral response. While 48 (31.5%) of the respondents opined that the above-mentioned learning methods might not be adequate to gain thorough clinical anatomy knowledge. The observed median value was 2 (IQR 2–4).

The next six questions were asked to understand the attitude of the surgical residents regarding the accentuation of their anatomical knowledge by a clinical anatomist (Tab. 2).

4) Along with the above-mentioned learning methods, regional anatomy orientation by a clinical anatomist will improve the depth of your surgical knowledge.

The participants responded on a 5-point Likert scale in response to the question. A total of 132 (87%) volunteers agreed that a clinical anatomist would accentuate their regional anatomy knowledge. Seventeen (11.1%) of them gave a neutral response. Four (2.6%) of the responders did not feel it was required. The observed median value was 4 (IQR 4–5).

5) Teaching outside the operation you will have a better understanding of the surgical procedures if you are briefed on the regional anatomy using prosected specimens the day before the procedure.

Overall, 137 (89%) of the participants opined that a targeted briefing of the regional anatomy prior to the surgical procedure would be very helpful (agree/strongly agree). 9 (5.9%) of the responders were neutral and 7 (4.6%) of the participants felt that this teaching technique would not refine their regional anatomy knowledge. The observed median value was 4 (IQR 4–5).

a) Teaching inside the operation Intra-operative extensive regional anatomy learning will be aided by the presence of a clinical anatomist.

One hundred and six responders (70%) thought that orientation by a clinical anatomist inside the operation theatre would enhance their regional anatomy understanding. Twenty-eight (18%) participants gave a neutral response, while 19 (12%) participants did not find this learning method useful. The observed median value was 4 (IQR 3–4).

b) Teaching in the operating room: The presence of a clinical anatomist will aid in the detailed study of the operated specimen inside the operating room.

One hundred and three (68%) participants concurred that guided study of the operated specimens would be very useful for them. 36 (24%) did not favor any response and 13 (8.5%) participants disagreed with it. The observed median value was 4 (IQR 3–4).

Tab. 1. Summary of opinions of surgical residents on their attitude towards their current knowledge of anatomy for surgical practice(frequency distribution, median & interquartile range – IQR).

Questionnaire	All participants (n=153)	All participants (n=153)	Residency year 1 (n=35)	Residency year 2 (n=22)	Residency year 3 (n=96)
1. Without the knowledge of detailed anatomy doing surgery is like travelling through an uncharted sea. Do you agree with this statement?	151 (99%)	–	34 (97%)	22 (100%)	95 (99%)
2. Do you think as a surgical resident you have adequate knowledge of regional anatomy in context with the surgeries performed?	96 (63%)	Median=2 IQR=1	19 (54.6%)	18 (82.1%)	59 (62%)
Strongly disagree +Disagree	28 (18.3%)		8 (22.9%)	3 (14%)	17 (18%)
3. Is self-directed learning (books and internet sources) along with senior surgeons teaching anatomy in operating rooms enough to thoroughly prepare for performing/ assisting surgeries?					
Strongly agree +Agree	77 (50%)	Median=2 IQR=2	16 (45%)	14 (63%)	47 (49.3%)
Strongly disagree + Disagree	48 (31.5%)		10 (28.9%)	3 (14%)	35 (36.4%)

Tab. 2. Summary of opinions of surgical residents on their attitude towards accentuation of their anatomical knowledge by clinical anatomists (frequency distribution, median & interquartile range – IQR).

Questionnaire	All participants (n=153)	All participants (n=153)	Residency year 1 (n=35)	Residency year 2 (n=22)	Residency year 3 (n=96)
4. Along with the above-mentioned learning methods regional anatomy orientation by a clinical anatomist will improve the depth of your surgical knowledge.					
Strongly agree + Agree	132 (87%)	Median=4	30 (85%)	19 (86%)	83 (87%)
Strongly disagree + Disagree	4 (2.6%)	IQR=1	1 (2.9%)	0 (0%)	3 (3.1%)
5. Teaching outside the operation theater: You will get better orientation of the surgical procedures if you are briefed about the regional anatomy using prosected specimens a day before the actual procedure.					
Strongly agree + Agree	137 (89%)	Median=4	33 (95%)	18 (82%)	86 (90%)
Strongly disagree + Disagree	7 (4.6%)	IQR=1	0 (0%)	2 (9.1%)	5 (5.2%)
6a. Teaching inside the operation theater: Intra-operative extensive regional anatomy learning will be aided by the presence of a clinical anatomist.					
Strongly agree + Agree	106 (70%)	Median=4	26 (74%)	17 (77%)	63 (66%)
Strongly disagree + Disagree	19 (12%)	IQR=1	4 (11.5%)	3 (13.6%)	12 (12%)
6b. Teaching inside the operation theater: Detailed study of the operated specimen inside the operating theater will be aided by the presence of a clinical anatomist.					
Strongly Agree + Agree	103 (68%)	Median=4	30 (86%)	15 (68%)	58 (61%)
Strongly disagree + Disagree	13 (8.5%)	IQR=1	23(8.6%)	4 (18.5%)	6 (6.2%)
7. A clinical anatomist working along with a surgeon will form an ideal learning platform both before and during a surgical procedure.					
Strongly agree + Agree	119 (78%)	Median=4	30 (86%)	17 (77%)	72 (75%)
Strongly disagree+ Disagree	15 (9.8%)	IQR=0	2 (5.8%)	3 (14%)	10 (10.4%)
8. Revisiting the cadaveric dissection will improve your anatomical comprehension about the surgical procedure.					
Strongly agree + Agree	135 (88%)	Median=4 IQR=1	27 (77%)	18 (82%)	90 (94%)
Strongly disagree+ Disagree	11 (7.2%)		6(16.8%)	4 (18%)	1 (1%)

7) A clinical anatomist working along with a surgeon will form an ideal learning platform both before and during a surgical procedure.

Overall, 119 (78%) of the respondents agreed that an integrated platform involving a clinical anatomist would be an effective teaching method. 19 (12%) participants were unbiased to any response, while 15 (9.8%) respondents differed with the proposed method of up skilling. The observed median value was 4 (IQR 4–4).

The next question was asked to understand the attitude of the surgical residents regarding the accentuation of their anatomical knowledge by revisiting cadaver dissection (Tab. 2).

8) Revisiting the cadaveric dissection will improve your anatomical understanding of the surgical procedure.

A majority of the responders 135 (88%) felt the pressing need to implement cadaveric dissection as a part of the postgraduate curriculum. 7 (4.6%) participants gave a neutral response. Eleven (7.2%) participants felt this concept would be of no

additional value to them. The observed median value was 4 (IQR 4–5).

The summary of the opinions submitted by all the participants and their categorical division into responders of first, second, and third years of residency is given in Tables 1-3.

The last two questions were open-ended and thematically analyzed and grouped under different subtopics (Tab. 3).

9) Thematic analysis of open-ended question 1. In your opinion, if you think the presence of a clinical anatomist outside and inside the operating room will definitely aid in making you a better surgeon, then why has such a system not been implemented in the PG curriculum yet?

One hundred and seventeen participants responded to this question. The responses were broadly classified into nine subgroups depending upon the likeness of the answers. The categorization included time constraint, inadequate curriculum, lack of resources, lack of clinical anatomists, lack of innovativeness, not required, don't know, ego of surgeons/hesitation

Tab. 3. Thematic analysis of open-ended questions.

In your opinion if you think presence of a clinical anatomist outside and inside the operating room will definitely aid in making you a better surgeon, then why has such a system not been implemented in PG curriculum yet?		Suggest the surgical areas you would like to be covered in detail if such integrated clinical anatomy sessions are included as a part of PG curriculum?	
Type of Responses	Responses (n=117)	Type of Responses	Responses (n=110)
Time constraint	32 (27.3%)	Abdomen and pelvis (hepatobiliary)	25 (22.7%)
Inadequate curriculum	24 (20.5%)	Head & Neck	23 (20.9%)
Lack of resources	12 (10.3%)	Thoracic anatomy	13 (11.6%)
Ego of surgeons/ hesitation to acknowledge	10(8.5%)	Hand and foot anatomy	10 (9%)
Lack of innovativeness	16 (13.6%)	Retroperitoneal structures	8 (7.3%)
Don't know	4 (3.4%)	Surgical anatomy of hip, knee and spine	6 (5.5%)
Not required	7 (6%)	Skull base and neuroanatomy	6 (5.5%)
Lack of clinical anatomists	7 (6%)	Anatomy of perineum	1 (0.9%)
Lack of interdepartmental coordination	5 (4.3%)	Subspeciality specific	18 (16.6%)

to acknowledge and lack of interdepartmental coordination. Time constraints (27.3%) and inadequate curriculum (20.5%) were the most widely reported hindering factors in implementing clinical anatomy teaching in surgical residency programs. The quantitative display of the responses is shown in Table 3.

10) Thematic analysis of open-ended question 2. Suggest the surgical areas you would like to be covered in detail if such integrated clinical anatomy sessions are included as a part of the PG curriculum?

We received 110 responses. The suggested clinical anatomy topics are given in Table 4. The most frequently suggested regions to be discussed were the abdomen and pelvis (22.7%) followed by head and neck anatomy (20.9%).

The responses from third-year residents were compared against the responses of first and second-year residents to understand whether the longer duration of surgical experience affected the formation of their opinions on the various questions which were asked in the present survey. Among the responders, 96 were third-year residents and 57 were first- and second-year residents combined. Statistical analysis revealed that third-year residents strongly agreed on the need to revisit the cadaveric dissection in order to improve their surgical expertise (p value 0.001). No significant difference was found between the responses of all the other questions (Tab. 4).

Discussion

The significant role of anatomy in the medical students' educational process, on both a cognitive and emotional level, has been well studied and elaborately described by Netterstrom et al (14). Studying human gross anatomy forms one of the important cornerstones for not only the development of surgical skills, but also supports the patients' examination to reach a proper diagnosis (9). Anatomy has been steadily overlooked in the current postgraduate medical curriculum (15, 16). The need to reinforce anatomy teaching before the graduates enter the residency programs has been reflected in a few studies (13, 17). In some universities, a postgraduate diploma in surgical anatomy and accredited courses in surgical anatomy are offered to acquire sound anatomy knowledge for safe

clinical practice (18, 19). Cottam conducted a survey to learn how sufficient the anatomy knowledge of the medical students who entered the residency programs was. The survey was targeted at the residency program directors in the USA. It was found that 57% of residency program directors felt that residents needed a refresher course in anatomy, 14% felt that the residents were deficient and 41% said that the residents were less well prepared than those of 10 years ago (20). Watersten et al conducted a survey among clinicians in the UK to assess their outlook on the current anatomy knowledge of medical graduates. They have reported that the majority of the clinicians in their survey felt that the knowledge of anatomy had fallen much beyond what is required for safe medical practice (21). Some of the studies done in the past actually assessed the level of anatomy knowledge among the junior doctors by means of multiple-choice questions. Gupta et al in their study examined the level of knowledge of applied clinical anatomy among junior doctors by giving questionnaires covering 15 areas of anatomy. They concluded that intensive clinical anatomy training is indispensable for evolution of tomorrow's clinicians (2).

In the present study, when asked about their current anatomy knowledge, 63% of the participants felt that they had adequate clinical anatomy knowledge and 50% of the responders felt that the current teaching and learning methods were sufficient.

A thorough literature search did not reveal any studies targeted at surgical residents' attitudes to learning anatomy. The need to revisit anatomy has been reinforced again and again over time, but not many studies have surveyed the actual approach in which it can be done or determined how significant the role of a clinical anatomist in teaching surgical trainees is. In fact, we could only find one study done by Hubbell et al where they have suggested a system of instruction in which regional anatomy is taught both before and during surgical procedures in the operating room. The majority of the students opined that such an approach was of great help in refreshing their clinical anatomy knowledge (22, 23). In the present study, 89% of the responders opined that a targeted briefing of the regional anatomy prior to the surgical procedure would be very helpful, and 70% of the participants thought that orientation by a clinical anatomist inside the operation theatre would enhance their regional anatomy understanding.

Tab. 4. Comparison of responses from third year surgical residents against responses from first- and second-year residents.

Questionnaire	Residency year 1 & 2 (n=57)	Residency year 3 (n=96)	p
Do you think as a surgical resident you have adequate knowledge of regional anatomy in context to the surgeries performed?			
Agree (agree + strongly agree)	37 (77%)	59 (78%)	>0.9
Disagree (disagree + strongly disagree)	11 (23%)	17 (22%)	
Is self-directed learning (books and internet sources) along with senior surgeons teaching anatomy in operating rooms enough to thoroughly prepare for performing/ assisting surgeries?			
Agree (agree + strongly agree)	30 (70%)	47 (57%)	0.2
Disagree (disagree + strongly disagree)	13 (30%)	35 (43%)	
Along with the above-mentioned learning methods regional anatomy orientation by a clinical anatomist will improve the depth of your surgical knowledge.			
Agree (agree + strongly agree)	49 (98%)	83 (97%)	>0.9
Disagree (disagree + strongly disagree)	1 (2.0%)	3 (3.5%)	
Teaching outside the operation theater: You will get better orientation of the surgical procedures if you are briefed about the regional anatomy using prosected specimens a day before the actual procedure.			
Agree (agree + strongly agree)	51 (96%)	86 (95%)	>0.9
Disagree (disagree + strongly disagree)	2 (3.8%)	5 (5.5%)	
Teaching inside the operation theater: Intra-operative extensive regional anatomy learning will be aided by the presence of a clinical anatomist.			
Agree (agree + strongly agree)	43 (86%)	63 (84%)	0.8
Disagree (disagree + strongly disagree)	7 (14%)	12 (16%)	
Teaching inside the operation theater: Detailed study of the operated specimen inside the operating theater will be aided by the presence of a clinical anatomist.			
Agree (agree + strongly agree)	45 (87%)	59 (91%)	0.6
Disagree (disagree + strongly disagree)	7 (13%)	6 (9.2%)	
A clinical anatomist working along with a surgeon will form an ideal learning platform both before and during a surgical procedure.			
Agree (agree + strongly agree)	47 (90%)	72 (88%)	0.6
Disagree (disagree + strongly disagree)	5 (9.6%)	10 (12%)	
Revisiting the cadaveric dissection will improve your anatomical comprehension about the surgical procedure.			
Agree (agree + strongly agree)	45 (83%)	90 (99%)	<0.001*
Disagree (disagree + strongly disagree)	9 (17%)	1 (1.1%)	

In their view, Singh et al have suggested various approaches to refresh anatomy knowledge during surgical practice. They have strongly recommended that attempting the same surgical procedure on a cadaver before the actual procedure in a patient will increase the confidence of the surgeon and also decrease the failure rates (24). Revisiting the surgical anatomy by final year undergraduate students and postgraduate students prior to surgical management of a case was found effective in a Malaysian study (23). Similarly a recent study in Scotland found that revisiting the clinical anatomy by postgraduate surgical trainees can add significantly to their surgical skills (25). In the current survey, 88% of the participants felt the necessity to implement cadaveric dissection as a part of the postgraduate curriculum. The responses of the third year's surgical residents of the various surgical specialties were statistically significant when compared to the responses of the first- and second-year residents. This suggests that in the later years of the residency program, when the residents start doing the surgeries independently, they actually feel the need to up-skill themselves by doing the same procedure on the cadavers.

We attempted to analyze the hindrances in incorporating such a system of integration within the postgraduate curriculum. To this, the majority of the responders felt that time constraints and an inadequate curriculum were the major obstructing elements. It is very difficult for the surgical faculties to provide adequate anatomy background to their residents for the surgical procedure being done, as reflected by the participants, that limited time is a major factor. For both the major hindrance factors, one effective solution will be to integrate postgraduate teaching with the department of Anatomy. To implement such a system where a clinical anatomist can brief before or during a surgical procedure itself is a very challenging task. As suggested by the responses in the current survey, it will be a challenge to overcome the ego bias of the operating surgeons.

Conclusion

An integrated approach between surgeons and anatomists can be successfully implemented to design an ideal platform for the

specialty training of surgical resident. This is a pre-trial research survey hence can only be used as a base line data to implement integrated clinical anatomy classes for the surgical residents. Implementation of a dedicated full-time course with a pretest, posttest evaluation and feedback analysis will give substantial evidence for modification of postgraduate curriculum.

Learning points

The article describes the need for vertical integration between anatomy and surgical specialties as part of postgraduate surgical curriculum as opined by the surgical residents. We have focused the survey on the opinions of the surgical residents whether they felt the need of a clinical anatomist as a part of postgraduate teaching team. The article is very much relevant considering the worldwide implementation of competency based medical education curriculum.

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