Original Article

Laparoscopy training status in India and a review of the current resident skill standards

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Abstract

Context: The aim was to identify the current training standard of laparoscopy skills among the urology residents.

Aims: This paper presents the residents' subjective perception of their laparoscopy skills and evidence of an objective assessment of their actual skills.

Settings and Design: An online survey was mailed, and completed by urology residents in training. The residents' perception of laparoscopy training received, exposure to laparoscopy procedures, and training facilities were queried. The assessment was done on the skill levels of the residents presenting at an annual training program.

Subjects and Methods: 103 residents responded to the online survey and 115 residents were assessed at the training program.

Statistical Analysis Used: Discrete data were compared using the *t*-test to test for significance of the means; $P < 0.05$ was considered significant. Pearson's correlation coefficient was used to obtain the relationship between variables.

Results: An overwhelming 91% rated their laparoscopy skill as just "satisfactory" or worse, and 60% did not have any training facilities in their department. 66% continue to be "assistants only" in conventional laparoscopy surgeries. Assessment of basic laparoscopy skills in the dry lab revealed 92% of residents having poor laparoscopy skills; similar to the subjective opinion in the survey. Only 6% ($n = 5$) of the residents showed a good or better skill score in the dry lab; similar to the survey.

Conclusions: Based on the survey, a large number of residents have a poor opinion of their own laparoscopy skills, and the training facilities available to them. The data objectively prove the self-assessment of the residents on their laparoscopy skill level.

Keywords: Curriculum, laparoscopy, standards, training

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INTRODUCTION

Since its introduction in the mid 80s laparoscopy has grown tremendously to encompass every subspecialty; needless to say the urological specialty has not been

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spared either. The range of procedures in urology ranges from simple diagnostic laparoscopy to advanced procedures both reconstructive and ablative namely - transplantation to cystoprostatectomies with total intracorporeal reconstruction.

Yet for surgeons to reach this level of expertise the story always begins from the simple yet crucial steps of basic laparoscopy. None of the medical schools or hospitals in India have a structured training program for laparoscopy leave alone other open surgical procedures.[1] Even in the existing colleges and hospitals, there is a significant discrepancy in training; with some centers being able to offer training in even advanced laparoscopy due to the volumes of cases they operate and other no exposure at all.

The residents in our system deserve to finish their training program with the knowledge and skill necessary to perform at least basic laparoscopic procedures safely. It is therefore "important for the urological community and stakeholders to understand the current practices of laparoscopic training during residency"[2] in India too.

"No more debating the validity of this pioneering technique (laparoscopic surgery), but yes, we are concerned with how to educate and train residents and surgeons."[3]

We decided therefore to obtain answers to two very crucial questions. Firstly; what was the subjective opinion of the urology residents about the level of their laparoscopy skills and training imparted. Secondly; is this borne out by actual assessment of their skill level.

SUBJECTS AND METHODS

There were two parts to the study, in the first we obtained information on the workplace, exposure to laparoscopy, skills level, and laparoscopy specific future goals of the residents in Urology. In the second part, we analyzed their actual skills from data obtained during the Urology Medical Education and Technology (UROMET) program conducted by the board of education (BOE), a wing of the Urological Society of India.

We modified an existing survey conducted for European urology residents and prepared a list of 18 questions designed to obtain the information as listed above. A survey was then created online using the tools provided by SurveyMonkey (SurveyMonkey™, Palo Alto, USA) and subsequently, the survey was mailed to all members of the USI (Urological Society of India). The survey began with an upfront question that it was to be completed only by urology residents in training. 103 responses were received and the data from these responses were analyzed.

The second set of data was obtained from the UROMET (Urology Medical Education and Training) program conducted for residents under the supervision of the BOE. The data were obtained by subjecting the residents to a series of skill demonstrations on selected laparoscopy modules. A scoring system was developed which rated the residents based on their skill levels.

The modules used were based on similar modules used in the European Urology Residents Education Programme [Table 1].

They included a camera module (tests the ability to orient and handle the laparoscopy camera), peg module, threading module (tests the ability of ambidexterity, precision, and perception with a penalty for dopping pegs, inability to complete threading), and suturing module (test all the above abilities to complete a knot, with penalty for breaking the suture and inability to complete a knot).

A score was derived by an objective assessment of the time taken to complete the task of the modules to which a penalty time was added (the penalty was based on the number of errors while completing the modules). A skill level was obtained by a subjective assessment of bimanual dexterity, depth perception, and overall efficiency using a Likert type scale of 1–5 as assessed by the mentor followed by averaging the three scores.[4] The final grade of the resident was thus based on the average time taken to complete the modules and the skill level demonstrated; and the residents were scored as having skill levels A, B, C, or D (with A being excellent and D being poor skill level) [Table 2]. A total of 114 residents were assessed from the years 2016–2018 and the data obtained were analyzed.

RESULTS

Analysis of the survey

The general demography data analysis reveals that majority of the residents were in the age group of 31–35 years, 66% (n = 69), followed by 24–30 years, 18% (n = 19), 36–40 years, 10% (n = 11), and >40 years, 3% (n = 4).

The distribution of the responses across types of institution revealed that 40% (n = 42) were from government centers, 32% (n = 33) from private institutes and the remaining 27% (n = 28) from private hospitals. Distribution of the residents by the year of residency revealed 81% (n = 84) were from the 3rd year, 14% (n = 15) from the 2nd year and 3% (n = 4) from the 1st year of residency. Nearly half the departments

Table 1: The standard tool used as per the European association of urology laparoscopy exercises

https://uroweb.org/education/online-education/surgical-education/laparoscopy/peg-transfer/
This exercise to assess ambidexterity times the trainee to a fixed time of 126 s, with error recorded as a peg which is dropped
https://uroweb.org/education/online-education/surgical-education/laparoscopy/cutting-a-circle/
This exercise assesses the cutting skills of a trainee to a fixed time of 151 s, with error recorded as cutting in or beyond the marked circles
https://uroweb.org/education/online-education/surgical-education/laparoscopy/needle-guidance/
This exercise assesses the ambidexterity and needle positioning in the needle drivers, with error recorded as entering a ring on the wrong side
https://uroweb.org/education/online-education/surgical-education/laparoscopy/laparoscopic-suturing/
This exercise assesses the endoscopic knot tying skill, with a target time of 360 s and errors recorded as stitch beyond 1 mm of the black dots in one or both dots, gap remains in the slit of the Penrose drain after tying the knot, slipping knot, the Penrose drain comes loose from the board and the Penrose drain is torn apart

Table 2: The scoring system

Consisted of an objective score for each exercise the resident was able to complete, with penalties for errors and a mean score calculated for the 4 exercises together
A grade was then assigned based on the final score (Final score=Sum of all individual scores/4)
204 s or lesser=A
205-224=B
225-244=C
245-264 or greater=D
For camera module: Expected time to finish 126 s penalty: If unable to complete add 50 s to overall time
Score=(Time taken to complete exercise in seconds+penalty time if any)-126 s
For peg module: Expected time to finish 126 s; penalty; add 10 s to total time for each peg dropped to overall time
Score=(Time taken to complete exercise in seconds+penalty time if any)-126 s
For threading/needle guidance module: Expected time to finish 268 s; penalty; unable to complete on time add 50 s, breaks suture add 50 s, enters ring from wrong side add 10 s total time
Score=(Time taken to complete exercise in seconds+penalty time if any)-268 s
For cutting module: Expected time to finish 151 s; penalty; unable to complete add 50 s to the overall time
Score=(Time taken to complete exercise in seconds+penalty time if any)-151 s
For the suturing module: Expected time to finish 360 s; penalty; unable to complete on time: Add 50 s, breaks suture add 50 s total time
Score=(Time taken to complete exercise in seconds+penalty time if any)-360 s
Overall skill assessment-was the subjective component of the scoring system where the mentors awarded a score under three headings of depth perception, ambidexterity, and overall efficiency. On a scale of 1-5. The average score if 3 or greater was awarded a plus in the skill level and anything lesser was awarded a minus
The final outcome was, therefore, a marking ranging from A-plus to D-minus

48% (n = 50) had a total of 1–3 resident, 37% (n = 39) had 4–6 residents, 12% (n = 13) had 7–9 residents and 0.97% (n = 1) had greater than 9 resident per academic year.

A majority, 52% (n = 54) of the departments appear to perform 1–50 laparoscopic procedures per year, 22% (n = 23) perform 51–100 procedures, 8% (n = 9) perform 101–150 procedures, 6% (n = 7) perform 151–200 procedures and 9% (n = 10) perform >200 procedures/year.

Further analysis of the type of laparoscopic procedures available at the centers reveals, that even now 4% (n = 4) residents have no laparoscopy exposure (as the names and mail id were kept anonymous it is not possible to comment if this is at more than one center). 23% (n = 24) of residents are performing conventional laparoscopy and 5% (n-6) were even performing robotic surgery. Robotic surgery exposure is available to 26% (n = 27) of the residents. However, a majority of 66% (68) residents continue to be assistants and 6% (n = 7) as observers even during conventional laparoscopy.

An overwhelming 95% (n = 98) of residents have a "very high" to "high" interest in performing laparoscopy, however 86% (n = 89) rate their skill level as only "satisfactory" to "very poor". Expectations are not high either 46% (n = 48), at least hope their skill level would rate as "good" by the time they completed their residency training.

Residents revealed the commonest surgery performed by them as a first surgeon was a simple nephrectomy 28% (n = 29), pyeloplasty 21% (n = 22), radical nephrectomy 21% (n = 22) followed by ureterolithotomy 20% (n = 21) and orchidopexy at 15% (n = 16). Of those residents who responded 69% (n = 72) have not even started performing laparoscopy surgery, and 81% of the respondents are in their 3rd year.

Looking at the training facilities that the residents have access to; again reveals a dismal picture, 61% (n = 63) have no access to any type of training facility, 27% (n = 28) have a dry lab, 13% (n = 14) have access to a simulation lab, 9% (n = 10) to a virtual reality facility and 1%–5% (n = 2 to n = 6) have access to a cadaver lab and a wet animal lab facility respectively. Among those that have access to a training facility, it appears that 56% (n = 33) need to achieve a minimum level of proficiency before they attempt live surgery.

In keeping with the number who have no access to the training facility, 58% (n = 60) are definitely considering a training fellowship/course in laparoscopy after their residency, 54% (n = 56) have already attended some form of training program during their residency.

Overall, the opinion of about 66% (n = 68) residents appears that they must be allowed more training in laparoscopy during the residency program itself. Access to training tools is the second most common opinion at 45% (n = 47) followed by exchange programs at 36% (n = 38).

Analysis of the UROMET data

Analysis of the data revealed, the final score had no significant association with the zone from which the resident was being trained (North, East, West, or South), the number of cases they had scrubbed for during their 1st and 2nd years of residency or exposure to laparoscopy during surgical residency.

The final score however showed a significant relationship to the depth perception skill (r = 0.893, P < 0.0001), the ability to be ambidextrous (r = 0.856, P < 0.0001) and the overall efficiency (r = 0.921, P < 0.0001) in the modules. Subanalysis reveals that dexterity was directly related to the ability to avoid dropping pegs in the peg transfer module (P = 0.008) and also the ability to complete the process of creating a knot (P = 0.001).

Data of the final grade revealed that 64% of residents had poor to very poor skill levels which correspond to the 62% of residents, who revealed in the survey that their subjective skill level, ranged from poor to none.

DISCUSSION

A direct comparison with a similar resident training program in other countries may be difficult as they have a 6 years training program, we can use other data available in these studies. It appears that a vast majority of our resident are training in institutes with access to laparoscopy as per the survey, with only a minority of 4% having no access to laparoscopy as compared to Europe where still 12%[2] residents train in departments with no laparoscopy procedures being performed. The mean age across countries of the residents appears similar with 69% in the age group of 31–35 years in India, about 80% in the age group of 26–35 in Europe,[2] and the average age being 29.1 years in Belgium.[5] Once more comparison of the type of institutes where the residents worked was difficult, with 27% (n = 28) of our residents training in private hospitals, whereas 36%[2] in Europe trained in "private" or "nonacademic institutes"[2] 58% of residents in Europe trained in "academic" institutes while in our case 72% trained at "government colleges" or "private colleges" if we consider both these groups as academic institutes.

It is heartening to note that exposure to robotic surgery is available to 26% of our residents while in Europe the exposure was to 17%[2] (the paper however was published in 2013, there definitely is an increasing adoption of the robot worldwide hence this gap may have reduced since).

In conventional laparoscopy too, our residents appear to have an edge over their European counterparts with 89% (66% assistants + 23% surgeons) actively involved in laparoscopy as compared to 70%[2] (43% assistants + 27% surgeons).

If one looks at the head to head comparison of the procedures performed in Table 3, the numbers are mixed with data being there for some procedures and missing for others; however, there appears to be a significant difference between both the Indian and European residents versus the Belgian residents.

In the surgery that is at least the standard of care, a simple nephrectomy the Indian residents appear to be at a disadvantage to their European counterparts. It must be kept in mind, though that the above numbers are for residents in their 5th and 6th year residency in Belgium,[5] and the same data are not available for the European residents.

Indian residents (filtered for 3rd year residents) rated their laparoscopy skills as "poor" to "none" in 61%, while only 49%[2] of the European residents voiced a similar opinion by the end of their residency. This clearly indicates a lot more training is needed to reach a level playing field.

There is sufficient evidence to show training in dry laboratories[4] does improve the skill in real-time surgery, it is, therefore, an urgent need to provide these training facilities for the residents who have no access to them. Compared to 42%[2] of European residents with no training facility in their institution 61% of Indian residents have no access to any kind of training facility.

Table 4 reveals in detail the types of training facilities available across Indian, European, and Belgian residents.

While 56% of Indian residents reported that they needed to attain a certain level of proficiency in the lab before being allowed to operate it does not match the fact, that 61% do not have access to a training facility at all. The Belgian residents revealed that among them, 15%[5] required to reach a specific skill level before being allowed to operate.[5]

Table 3: Head to head comparison of the procedures performed by Indian residents versus European residents

Procedure	Indian residents (*n*=103), *n* (%)			European residents[2] (*n*=219), *n* (%)			Belgian residents[5] (*n*=NA), *n* (%)		
	Number of cases performed								
	1-10	>10	Total	1-10	>10	Total	1-10	>10	Total
Simple nephrectomy	19.42	8.74	28.16	28	4	32	82	0	82
Radical nephrectomy	17.48	3.88	21.36	NA	NA	NA	NA	NA	NA
Partial nephrectomy	5.83	0.97	6.81	10	0	10	0	0	0
Adrenalectomy	9.71	0.97	10.68	NA	NA	NA	NA	NA	NA
Pyeloplasty	18.45	2.91	21.36	13	0	13	45	NA	45
Ureterolithotomy	13.59	6.80	20.39	NA	NA	NA	NA	NA	NA
Orchidopexy	11.65	3.88	15.53	NA	NA	NA	7.6	0	7.6
Radical cystectomy	NA	NA	NA	4	0	4	NA	NA	NA
Nephrouretrectomy	NA	NA	NA	NA	NA	NA	46	0	46
Radical prostatectomy	NA	NA	NA	11	1	12	23	0	23

NA: Data not available

Table 4: Availability of dry laboratories to residents

Training facility	Indian residents (%)	European residents[2] (%)	Belgian residents[5] (%)
None	61	42	NA
Dry lab	27	33	70
Wet lab/animal lab	5	10	~55
Cadaver lab	2	4	0
Virtual reality/computer simulation	23	44	50

NA: Data not available

Among the Belgian residents, a total of 47%[5] of the urology trainees had the possibility of getting skills lab training. They reported that their performances were measured during training. "In most cases, 'time to complete an exercise' was the only performance measurement, except for gynecology trainees, among whom 5.5% reported the use of a procedure-specific score."[5]

However, as seen across the whole spectrum of training in any field the time spent on training on practice modules was low. The Belgian residents revealed that the exposure to skill lab was in majority 1–2 times a year, mostly of duration between 1.5 and 3 h (very similar to the UROMET program). In those who had time for deliberate practice about 80% of residents practiced on the modules for <1 time/2 months (ref). Even if the residents had the modules at home they made little if any attempt to practice their skills.[5]

In keeping with the above levels of skill, it was not unusual to find 49% of the Indian residents had attended a training course at another hospital or by the national organization (possible the UROMET training lab). In comparison, 68%[2] of European residents and 52%[5] of Belgian residents had attended some form of national, international; course or fellowship not organized by their training universities.

The training in basic laparoscopy skills at the UROMET programs underlines the fact that training using a box trainer works by repeated practice to improve hand-eye coordination and manual dexterity. This ultimately will result in better performance during actual laparoscopy procedures.

A Cochrane review[4] of a large number of studies ($n = 32$) revealed that in students with no prior experience with laparoscopy when exposed to box training versus no training showed that time taken for task completion, error score, and the accuracy score was significantly shorter in the box trainer group than the control group. Overall the composite performance score in the box trainer group was significantly better than the control group.

Supe *et al*.,[6] de Win *et al*.[7] and Mackay *et al*.[8] have shown that training in a structured form using box trainers with schedules and skill evaluation led to better skills as opposed to conventional, opportunistic training. They also suggested frequent and shorter training session led to better skill retention.

Training boxes and modules also need to be made cheaper and easily available for either training centers to procure or for residents to procure for themselves. Dedicated skill practice sessions either at home or during working hours need to be made mandatory. Moreover, as de Win *et al*. emphasize "residents should also be confronted with the results of surgical education research showing that only proficiency scores on the simulator correlate with improved clinical performance."

With such a system in place, the next step would obviously be to encourage more residents to be first surgeons than

just assistants or observers. This would definitely reduce the need to conduct training fellowships for all but the most complex and demanding laparoscopy procedures.

The present study has some limitations, a low response rate (the response rate was not homogeneous across different states), as the survey could have been selectively answered by residents with a high degree of interest in laparoscopy or a low skill level leading to a possible selection bias. The scoring method in the UROMET too has limitations; there is no control group to assess the effect of the box-training, the resident selecting the program may have a special interest in laparoscopy, the final score is a result of a combination of numerical values while the skill level is assigned by nonblinded mentors who are training the candidates, adding to the possibility of a bias.

CONCLUSION

Based on the survey, a large number of our residents have a poor opinion of their own laparoscopy skills, and of the training facilities available to them. The UROMET data objectively prove the self-assessment of the residents on their laparoscopy skill level.

Significant attention will be needed to improve the training standards in laparoscopy of the Urology residents and may range from a more active role in laparoscopy surgeries to providing dry lab training facilities. A curriculum for urology residents specifying the number of cases for which they must assist or perform independently could be drawn up and will go a long way in standardizing the training pattern. In addition, certified (by the specialty national organization) fellowship programs could be started at centers which have a higher than mean volumes of certain subspecialty cases (e.g., laparoscopy, transplants, and uro-oncology to name a few), where residents could gain more experience if they feel the need. The skill level of our residents can be improved only by a synchronous effort of the training centers, the specialty national organization, industry-sponsored training facilities, and definitely not without the effort of the residents themselves.

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Conflicts of interest

There are no conflicts of interest.

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