Barriers and facilitators of laparoscopic surgical training in rural north-east India: a qualitative study

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Introduction: Laparoscopic surgery has advantages for treating many abdominal surgical conditions, but its use in low and middle-income countries (LMICs) is limited by many factors, including a lack of training opportunities. The aim of this study was to explore the training experiences of surgeons in rural north-east India to highlight the barriers and facilitators to laparoscopic surgery.

Methods: Eleven surgeons with experience in laparoscopy in rural north-east India were recruited using purposive and convenience sampling. Ethical approval was obtained from the Institutional Ethics Committee, Maulana Azad Medical College, New Delhi, India and the Leeds Institute of Health Sciences Research Ethics Sub-Committee, West Yorkshire, England. Consenting participants took part in semi-structured interviews, either between May 20 and 25, 2019 in rural north-east India or via Skype or at the University of Leeds in June 2019. Interviews were audio-recorded and transcribed and thematic content analysis performed.

Results: Exposure to laparoscopy during postgraduate training was common, but training experiences were inconsistent and informal. Alternative training opportunities are limited by availability and cost. There is high demand for a structured curriculum, incorporating formal assessment and credentialing, to include observation and assistance in live surgery and laparoscopic simulation.

Conclusions: Laparoscopic training experiences are highly variable, with limited training resources and lack of a curriculum. Poor accessibility is consistent with that recorded in literature. Current recommendations include government support and funding to guide development of a standardized curriculum and widen access to training programs for surgeons in rural settings.

Keywords: Laparoscopy, Surgical training, Global surgery, Rural surgery, Low resource

Laparoscopic surgery is commonly used in developed countries to treat many surgical conditions[1]. The recognized advantages over open surgery include reduction in postoperative pain[2], blood loss, risk of infection[3], and hospital stay[4]. The same benefits may be particularly relevant in low- and middle-income countries (LMICs), particularly in rural areas where surgical departments are under-resourced. However, the use of laparoscopy in LMICs is limited not only by resourcing and funding, but also the lack of training opportunities for health care workers[5].

Ensuring access to high-quality laparoscopic training opportunities in LMICs would have substantial benefits, including the hiring and retention of staff[6], and ensuring safe delivery of laparoscopic surgery[7]. Previous studies have only evaluated laparoscopic training programs in LMICs from the training providers’ perspective[8] or through quantitative methods[9].

India is a LMIC[10], with 68.8% of its population living in rural areas[11]. In the north-eastern region, with a population of 45 million people[12], an estimated 81.5% live in rural areas[13]. Access to surgical services in rural areas is particularly low[14], contributing to the increased morbidity and mortality[15]. However, laparoscopic surgery has been gaining popularity in rural India[12], with much interest shown by rural surgeons[16].

The Diplomate of the National Board in Rural Surgery (DNB —Rural Surgery), a qualification designed to produce “rural doctors with advanced training in rural generalist surgical skills,” does not include laparoscopic surgery in its curriculum[17]. A failure to follow the trend for laparoscopic surgery and utilize its benefits in under-resourced settings could further disadvantage rural surgeons and their patients. This study aimed to explore the training experiences of surgeons in rural north-east India in order to highlight the barriers and facilitators to such opportunities.

Methods

This research has been reported in line with the standards for reporting qualitative research guideline[18].
Ethical approval was provided by the Institutional Ethics Committee, Maulana Azad Medical College, New Delhi, India (F.1/IEC/MAMC/67/02/2019/No101) on May 15, 2019, and by the Leeds Institute of Health Sciences Research Ethics Sub-Committee, West Yorkshire, England (FMHREC-18-2.4) on May 20, 2019.

A phenomenological qualitative approach was used to explore “experience, meaning, and perspective” on training of rural surgeons. Semi-structured interviews (SSIs) were carried out, with use of a predetermined question guide (see Supplemental Digital Content 1, http://links.lww.com/IJSGH/A4, which shows the interview question guide) based around 4 topics: training experiences; demand for/accessibility of training; need for a training curriculum; and desirable features of a curriculum. This allowed control over the focus of the interview, to produce reliable and comparable data.

Purposive sampling was used to identify information-rich cases, with an element of convenience sampling. The NIHR Global Health Research Group—Surgical Technologies (GHRG-ST) in Leeds facilitated recruitment from a cohort of rural surgeons participating in a laparoscopic proctorship program in rural north-east India in May 2019. For inclusion into the study, participants had to be fluent in English, formally qualified doctors or surgeons (minimum MBBS or equivalent), and have experience practicing laparoscopic surgery independently, and working in a rural setting in India.

Potential participants were approached face-to-face on-site in India, or via email, for recruitment. Participants were briefed and given an information sheet (see Supplemental Digital Content 2, http://links.lww.com/IJSGH/A5, which shows the information sheet) explaining the background and purpose of the study, the voluntary nature of their involvement and what it would entail and relevant ethical considerations. Verbal and written consent (see Supplemental Digital Content 2, http://links.lww.com/IJSGH/A5, which shows the consent form) was obtained, and no incentives were offered for participation.

One researcher, a BSc and MBChB student, with no prior relationship with participants, conducted the interviews in English. Only the participant and researcher were present. Nine interviews were conducted face-to-face in India, at either a health center or participant accommodation, between May 20 and 25, 2019. One interview was postponed due to time constraints and conducted via Skype in June 2019. One further participant was recruited via email and interviewed on-site at the University of Leeds in June 2019. The question guide was adapted throughout data collection according to emerging themes highlighted in field notes. Data was audio-recorded with the participants’ consent and pseudonymized.

Interviews were transcribed verbatim, and thematic content analysis was used to allow flexibility and interpretation throughout analysis. A priori codes were highlighted, before an iterative analysis process allowed for continual review and assignment of emergent codes. This allowed exploration of themes from existing literature, as well as those appearing in the data. Codes were grouped and arranged into a thematic framework on Microsoft Excel, for identification of relationships between codes and themes.

**Results**

Twelve surgeons were approached, with 1 declining to participate due to personal time constraints. Eleven participants were recruited and interviewed for between 20 and 70 minutes. A summary of participant experience and characteristics is shown in Table 1.

Table 2 summarizes the barriers and facilitators identified, divided by 3 major themes, according to the coding tree; training experiences, accessibility of training programs, and features of a training program.

### Training experiences

### First exposure

Most surgeons were exposed to laparoscopy during their postgraduate training, either in their DNB or MS. The amount of

| Participant Code | DNB—Rural Surgery | MS General Surgery | Other | Current Designation | Rural Experience | Laparoscopic Experience (y) |
|------------------|-------------------|--------------------|-------|---------------------|-----------------|---------------------------|
| TE1              | Yes               |                    |       | Surgeon, rural district hospital | Multiple years | Multiple                  |
| TE2              | Yes               |                    |       | NA                  | Multiple years | 10 +                      |
| TE3              | Yes               |                    |       | Surgeon, rural district hospital | 17 y           | 10                        |
| TE4              | Yes               |                    |       | Medical Officer, rural government hospital | 10 y           | 7                         |
| TE5              | Yes               |                    |       | Consultant Surgeon, rural mission hospital | 7 y           | 7                         |
| TE6              | Yes               |                    |       | Surgeon, rural mission hospital | Multiple years | 1 +                       |
| TR1              | Yes               | MCh Pediatric Surgery |       | Assistant Professor, city-based medical college | Volunteering in surgical camps | 8                         |
| TR2              | Yes               | MCh Pediatric Surgery |       | Professor and Head of Department, city-based medical college | Setting up laparoscopic surgery in rural hospitals, volunteering in surgical camps | ~20                      |
| TR3              | Yes               | FNB—Minimal Access Surgery |       | Assistant Professor, city-based medical college | 1.5 y volunteering surgical camps | 7                         |
| TR4              | Yes               |                    |       | Associate Professor, city-based medical college | Volunteering in surgical camps and training programs | 8                         |
| TR5              | Yes               | MCh Urology         |       | Rural surgeon with interest in minimally invasive surgery | Extensive experience training and implementing laparoscopic programs | ~20                      |

1. **TE** = Trainee (in the GHRG-ST study)/TR = Trainer (in the GHRG-ST study).
2. DNB indicates Diplomate of the National Board; FNB, Fellowship in National Board; MCh, Master of Chirurgiae; MS, Master of Surgery.
Training experiences were largely informal and lacked structure, and few support materials were provided.

“There was no curriculum, there was no, actually, reading material that was provided for it.” TE2

Theoretical training was limited; some surgeons felt the need to further their knowledge independently.

“We are not taught about the complications of lap surgery … physiological changes in the CO2 level that we put … I studied this later on, when I started practising on my own.” TE1

**Accessibility of laparoscopic training**

**Availability of training programs**

Alternative ways to access training included seeking work at an established laparoscopic center, or independently funding a place on a training course. Ideas on availability of training programs in India were varied. Most participants said that availability was limited, especially for rural surgeons:

“I think we need more training centers for lap surgery than the few which are situated far, far away … training centers for lap surgery is available only in the cities.” TE6

Some more senior participants either had little awareness of the availability of training courses or described them as common in India.
Accessing training programs

Cost was a recurring theme as a barrier to accessing laparoscopic training, including the cost of the training program, accommodation and travel.

“Formal training programmes that are available are very expensive...they charge 20, 30 thousand rupees per day, which is quite a bit.” TR5

Loss of working days is also a barrier, due to limited free time, time away from family, and the associated loss of income.

Features of a training program

Qualification need

Many surgeons highlighted a gray area in the law around MBBS, which allowed graduates to practice laparoscopic surgery without further qualification. Increased confidence, legal protection in case of mistakes, and proof of proficiency were given as benefits to formal certification of laparoscopic training.

“If you are technically capable, it is very difficult for me to say you can’t do this or you can’t do that ... The law protects you if you have a degree [DNB—Rural Surgery], if you commit a mistake, because you are qualified.” TE2

Training methods

Observing and assisting. This was regarded as a vital part of any training program. A low student-mentor ratio was deemed to be desirable, and more achievable in a DNB than MS setting.

Many surgeons said trainees should be exposed over time to multiple laparoscopic techniques.

“Experience only from one surgeon is not enough ... everyone has their own techniques of small, small things, and those techniques, you need to learn and collect all the good skills from different surgeons, and then you select which is best for you.” TE6

As long as trainers are confident and diligent in supervision, the risk to patient safety from inexperienced laparoscopic surgeons was not seen as an issue. The importance of previous experience in open surgery was highlighted to ensure a good understanding of safe and careful practice.

One drawback of this training method was the limited time that trainees have to practise during live surgeries, so practise must be efficient.

“To hold their hand from behind and teach them how to move the instrument, and how to feel it, because we don’t have so much time. So, we need to practise on the patient properly.” TR1

Laparoscopic simulators. The use of laparoscopic simulators, or box trainers, was thought to be beneficial to improving hand-eye coordination, depth perception and operating speed, as well as familiarization with the 2D laparoscopic view.

“In a box, we can do anytime, we can do any mistakes, it doesn’t matter, but slowly you can master it.” TE1

Most surgeons thought that trainees should develop their skills on a simulator before progressing to live surgery exposure.

“They should start with a simulator first ... it is a little bit different from when they are seeing it in 3D and 2D, so you need to develop certain skills to adapt.” TR5

Background theory. Three surgeons highlighted the importance of sound knowledge in laparoscopy before practical training. One surgeon had experience in training visiting surgeons in laparoscopy, and gave them an online course to complete before proctorship began:

“Then we know that they already have some background, and they have taken the trouble to go through all the lessons and find out. Then it makes teaching, also, easier.” TR5

Assessment

A formal, standardized assessment was thought to be necessary alongside a curriculum. Benefits mentioned were further motivation to improve skills and a better awareness of their current abilities.

The objectivity of a standardized assessment was repeatedly mentioned; bias of mentors during informal assessments can cause risks to patient safety. One participant suggested that a third party should assess trainees in order to avoid this.

When to learn

Most agreed that laparoscopy should be compulsory in the DNB—Rural Surgery curriculum. A few suggested keeping the curriculum limited to only the most relevant skills.

“There’s no point in teaching them about, you know, high-level surgeries, because, in their lifetimes they’re never going to do it, or expose to it.” TR4

Only one surgeon thought that laparoscopy should not be on the DNB curriculum at all, as they doubted its current feasibility.

“I don’t want to make it an essential part of the rural curriculum, because there might be centres who are not doing laparoscopic surgery, so then, virtually, you are cutting them off from the rural surgery programme.” TR4

Where to learn

Three participants suggested that rural surgeons should receive training through local mentoring in their own setting, with appropriate facilities.

“It is important to learn at your place, with your equipment ... they have high-end equipment which makes surgeries very simple and easy. But, when you come here to a remote area, where you don’t have all the equipment and all the facilities.” TR5

It was suggested that this could take the form of proctorship after postgraduate qualification.
Discussion

Exposure of most of the surgeons to laparoscopy during postgraduate training is unsurprising, considering the increasing popularity of the technique, even in rural India[12]. Experiences of learning through observing and assisting in live surgery are in line with the literature from other LMICs[5]. However, it is surprising that patient safety was not seen as a major concern. Previous papers have highlighted observation and assistance of live surgeries by inexperienced trainees as an inappropriate and unethical training model, due to the high risk of patient complications[20]. Absence of this as a subtheme in this study may be due to ignorance of the dangers by the small study sample. Furthermore, surgeons with experience in training others in laparoscopy may have been reluctant to admit to patient safety concerns under their supervision.

Informal teaching experiences with a lack of theoretical training resources may reflect the limited availability of formal laparoscopic curriculums in LMICs, identified as one of the most significant barriers to laparoscopic training[21].

Opportunities to train in laparoscopy are varied and partly explained by the absence of laparoscopy on the DNB—Rural Surgery curriculum, with limited access to laparoscopic facilities. Some participants recommended local mentoring in their rural work environment as a preferable set-up. Cost of attendance, travel, and loss of working days was the most significant barrier to accessing alternative sources of laparoscopic training, as previously reported[8,22].

The desire for a laparoscopic qualification was an unexpected emerging theme, not found in previous literature. This could be because the “gray area” for laparoscopic practice in MBBS in India may not exist in other LMICs.

The widespread enthusiasm of the surgeons toward “observing and assisting” as a training method is anomalous among similar studies. As well as the ethical and safety issues, researchers have been highly critical of its lack of structure[5] and subjectivity[23].

Similar to in other studies[8], participants acknowledged many benefits of the use of box trainers, including overcoming the barrier of limited time to practice during live surgery. However, none of the surgeons had access to a box trainer during their initial laparoscopic training, which could reflect the cost of simulation equipment[20,24].

The need for a standardized, objective assessment of laparoscopic surgery was articulated, although few participants could suggest exactly what form this should take. Other training programs in LMICs have based assessment around western standards for laparoscopic training, which ultimately led to limited success[7] so caution should be exercised in this approach.

The benefits of laparoscopic surgery are well recognized among surgeons in rural north-east India, but the accessibility of quality training opportunities still falls behind other areas. State involvement may be beneficial in widening access to training programs, either through outreach proctorship camps in rural areas, or sponsorship for rural surgeons to access training centrally.

It would be desirable to develop a locally appropriate, peer-reviewed formal curriculum to aid the uptake of laparoscopic surgery. This would standardize and improve the quality of training, while facilitating development of further local training courses, and allowing formal recognition through qualification.

Inclusion of laparoscopy into postgraduate surgical curriculums, such as the DNB—Rural Surgery, might help to lower inequalities in training access, ensuring rural surgeons are appropriately trained in an increasingly popular technique with advantages for patients and health care providers.

This study, although small-scale and locally focused, highlights the inconsistency and inequality in laparoscopic training, even while the popularity of the technique continues to grow. Such inconsistencies must be explored internationally, and the success, or otherwise, of local training programs should be publicized so that LMICs can learn from each other.

This study suffers from limitations, mainly due to the difficult logistics around undertaking qualitative research in a remote setting. Purposive sampling means that data saturation was likely not reached, and an element of convenience sampling, used to accommodate the logistical challenges in undertaking the research, may have led to undesirable bias[25]. Furthermore, long-distance connectivity issues meant that the one SSI conducted via Skype gave limited data. No pilot interviews were conducted, which could have allowed for identification of flaws in the question guide[26], such as some prompts which had to be reworded due to participants’ misunderstanding. One researcher carried out data collection and previous reading and development of codes, which may have introduced a bias. Finally, data triangulation was not carried out, which is an important tool to test the validity of qualitative research[27]. Use of respondent validation after transcription was planned, but logistical restrictions prevented it.

Conclusion

This study has demonstrated the inconsistency and variability of laparoscopic training experiences in a small cohort of rural surgeons from north-east India. Recommendations to facilitate laparoscopic training include the development and implementation of training curricula, incorporating formal structure and standardized assessment.

Ethical approval

Ethical approval was provided by the Institutional Ethics Committee, Maulana Azad Medical College, New Delhi, India (F.1/IECMAMC/67/02/2019/No101) on May 15, 2019, and by the Leeds Institute of Health Sciences Research Ethics Sub-Committee, West Yorkshire, England (FMHREC-18-2.4) on May 20, 2019.

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Author contribution

E.W., N.A., and D.J.: study conception and design. E.W.: acquisition of data, analysis and interpretation of data, drafting of manuscript. E.W., N.A., and D.J.: critical revision. All authors final approval of manuscript.

Conflict of interest disclosures

The authors declare that they have no financial conflict of interest with regard to the content of this report.
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References

[1] Chao TE, Mandigo M, Opoku-Anane J, et al. Systematic review of laparoscopic surgery in low- and middle-income countries: benefits, challenges, and strategies. Surg Endosc 2016;30:1–10.
[2] Choy I, Kitto S, Adu-Aryee N, et al. Barriers to the uptake of laparoscopic surgery in a lower-middle-income country. Surg Endosc 2013;27:4009–15.
[3] Hussain A, Mahmood HK, Dulku K. Laparoscopic cholecystectomy can be safely performed in a resource-limited setting: the first 49 laparoscopic cholecystectomies in Yemen. J Soc Laparoendosc Surg 2008;12:71–6.
[4] Bedada AG, Hsiao M, Bakanisi B, et al. Establishing a contextually appropriate laparoscopic program in resource-restricted environments: experience in Botswana. Ann Surg 2013;261:807–11.
[5] Ala-Wali M, Osaghae S. Practice, training and safety of laparoscopic surgery in low and middle-income countries. World J Gastrointest Endosc 2017;9:13–8.
[6] Andreattta P, Perosky J, Klotz J, et al. Pilot study outcomes from a resource-limited setting for a low-cost training program for laparoscopic surgical skills. Int J Gynecol Obstet 2014;125:186–8.
[7] Asbun HJ, Berguer R, Altamirano R, et al. Implementation of laparoscopic surgery training via simulation in a low-income country. J Gynecol Obstet Hum Reprod 2018;47:187–91.
[8] Apostolou C, Panieri E. National Survey of Surgeon’s attitudes to laparoscopic surgical training in South Africa. South African J Surg 2007;45:86–91.
[9] The World Bank Group. India. 2019. Available at: https://data.worldbank.org/country/india. Accessed July 24, 2019.
[10] Singh MP, Luikham A, Symren W, et al. Basic Statistics of North Eastern Region 2015. Shillong: North Eastern Council Secretariat, Government of India; 2015.
[11] National Board of Examinations. Guidelines for Competency Based Training Programme in DNB—Rural Surgery. New Delhi.
[12] Gnanaraj J. Laparoscopic surgery in rural areas. ANZ J Surg 2007;77:799–800.
[13] Jami S, Gnanaraj J. Feasibility and issues related to performing laparoscopic surgeries in rural areas. CHRISMED J Heal Res 2015;2:87–90.
[14] O’Brien BC, Harris IB, Beckham TJ, et al. Standards for reporting qualitative research: a synthesis of recommendations. Acad Med 2014;89:1245–51.
[15] Hammarberg K, Kirkman M, De Lacey S. Qualitative research methods: when to use them and how to judge them. Hum Reprod 2016;31:498–501.
[16] Ayres L. Semi-structured interview. In: Given LM, editor. The SAGE Encyclopedia of Qualitative Research Methods. Los Angeles: SAGE Publications; 2008:810–1.
[17] Cohen D, Crabtree B. Qualitative Research Guidelines Project: Semi-Structured Interviews. 2006. Available at: http://www.qualres.org/HomeSemi-3629.html. Accessed July 24, 2019.
[18] Palinkas LA, Horwitz SM, Green CA, et al. Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. Adm Policy Ment Health 2015;42:533–44.
[19] Castleberry A, Nolen A. Thematic analysis of qualitative research data: is it as easy as it sounds? Curr Pharm Teach Learn 2018;10:807–15.
[20] Supe AN. Laparoscopic training in India: need for criterion-based training and objective assessment of surgical skills. Natl Med J India 2016;29:188–91.
[21] Robertson F, Mubazazi Z, Kyamanywa P, et al. Laparoscopy in Rwanda: a national assessment of utilization, demands, and perceived challenges. World J Surg 2019;43:339–45.
[22] Okrainec A, Henao O, Azzie G. Telesimulation: an effective method for teaching the fundamentals of laparoscopic surgery in resource-restricted countries. Surg Endosc 2010;24:417–22.
[23] Ghesquiere I, Garabedian C, Boukerrou M, et al. Laparoscopy in Rwanda—first 49 laparoscopic surgeries in rural areas. CHRISMED J Heal Res 2015;2:87–90.
[24] Beard JH, Akoko L, Mwanga A, et al. Manual laparoscopic skills development using a low-cost trainer box in Tanzania. J Surg Educ 2014;71:85–90.
[25] Ayres L. The use of triangulation in qualitative research: a synthesis of recommendations. Acad Med 2014;89:1245–51.
[26] Okrainec A, Henao O, Azzie G. Telesimulation: an effective method for teaching the fundamentals of laparoscopic surgery in resource-restricted countries. Surg Endosc 2010;24:417–22.
[27] Carter N, Bryant-Lukosius D, Dicenzo A, et al. The use of triangulation in qualitative research. Oncol Nurs Forum 2014;41:545–7.