

# Training and certification of EUS operators in China

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## ABSTRACT

**Background and Objectives:** EUS has become a very frequently used procedure for both diagnostic and therapeutic indications. However, skilled operators are essential for improved outcomes and patient safety which make efficient training and certification programs essential. Our aim was to explore the acquisition and assessment of EUS competencies in China as practiced in the past, today, and in the future. **Methods:** We identified key opinion leaders (KOLs) from hospitals in different cities in China. Each KOL answered 43 questions regarding demographics and EUS experience, their learning experience as a trainee, experience as a supervisor, and their thoughts about current and future training. Descriptive statistics were used for reporting the results. **Results:** Eleven men and five females from eight major Chinese cities (Beijing, Changsha, Chengdu, Chongqing, Guangzhou, Shanghai, Shenzhen, and Wuhan) were included. They offered a good variance regarding age (33–53 years old), EUS experience (½–20 years), and performed procedures (20–6000 procedures). Most ( $n = 13$ ) learned EUS through apprenticeship training model but three were self-taught. The KOLs also used the apprenticeship model to train their own trainees. First, they demonstrated EUS for median 2 months before their trainees took over the scope and performed a median 50 supervised procedures during a median of 3 months. Then they were allowed to perform EUS procedures independently. Simulation-based training and standardized assessment of competence were used very sparingly, but most of the KOLs wanted to shift towards these contemporary methods in the future. **Conclusions:** The classical apprenticeship training is still used to learn EUS in China and the amount of training required before being allowed to practice independently varies considerably. Several of the KOLs requested improved conditions for training and wanted a standardized curriculum leading to certification of new EUS operators based on a valid assessment of competence.

**Key words:** education, EUS, training

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## INTRODUCTION

EUS is gaining popularity across the globe for both tissue acquisition (fine needle aspiration and fine needle biopsy) and interventional procedures such as EUS-guided celiac plexus ablation, EUS-guided drainage, *etc.*<sup>[1,2]</sup> These procedures are technically challenging and competent operators are essential to ensure diagnostic yield, clinically successful procedures, and acceptable procedure times.<sup>[3,4]</sup> Competency in EUS can be acquired by studying books and videos, attending dedicated courses, through hands-on simulation-based training (SBT) on phantoms or animals, or using the traditional apprenticeship model where the trainee trains on patients under supervision by a more experienced colleague.<sup>[3-6]</sup> The goal of pre-patient training is to acquire the basic technical skills that will ease the transition into supervised practice, *i.e.*, that the patients are not forced to bear the burden of the trainee's initial learning curve.<sup>[7]</sup> Similarly, supervised training on patients should continue until the trainee is competent to perform individual, unsupervised EUS procedures.<sup>[8]</sup>

Traditionally, the number of performed procedures has been used to decide when a trainee is competent. However, trainees achieve procedural competency at different paces during training and this understanding has fueled the transition from volume-based to competency-based training models where dedicated assessments are performed to ensure that all trainees are competent.<sup>[9]</sup> Multiple simulator-based and patient-based assessment tools for different EUS procedures exist,<sup>[10]</sup> but there is a lack of knowledge on whether they are used systematically in different countries. Furthermore, there is no consensus on an international EUS curriculum, and it is largely unknown exactly how the different training modalities are used.

The aims of this study were to document the historical and current methods of acquiring (*i.e.* training) and ensuring (*i.e.* assessing) EUS competence in China, to investigate the satisfaction regarding current training facilities, and explore ideas for future improvements.

## MATERIALS AND METHODS

The study was conducted as an interview study using convenience sampling and structured individual interviews. We aimed to include key opinion leaders (KOLs) from at least ten different hospitals

from five major cities in China in order to ensure the generalizability of the findings.

A structured interview guide was created by two Chinese surgeons working professionally in medical education and a Danish cardiothoracic surgeon and professor of medical education. The interview guide consisted of 43 questions that were arranged in four sections: *Participant's demographics and EUS experience* (age, gender, *etc.*), *Participant's own learning experience as a trainee*, *Participant's experience as a supervisor*, and *Participant's thoughts on current and future training*. The complete interview guide is shown in Appendix A.

All interviews were conducted via teleconferences due to the ever-changing travel restrictions of the Covid-19 pandemic. Three interviewers (XH, JL, WH) performed all interviews together to ensure a uniform interview technique. All the data were carefully documented and transcribed by XH into a spreadsheet and were translated into English before being analyzed by LK. Data analysis was non-blinded, but bias was minimized as LK did not have any personal knowledge of any of the KOLs or their centers.

### Statistics

Descriptive statistics were used to report the findings. Means and standard deviations (SD) were used for normally distributed data, and medians and ranges were reported if the data were nonnormally distributed. Statistical analyses were performed using IBM SPSS Statistics 25.0 (SPSS 2017, Chicago, IL, USA).

## RESULTS

### *Participant's demographics and EUS experience*

Sixteen KOLs in EUS performance and training were interviewed. They came from 16 hospitals in eight different major Chinese cities (Beijing, Changsha, Chengdu, Chongqing, Guangzhou, Shanghai, Shenzhen, and Wuhan). The majority were from departments of gastroenterology ( $n = 14$ ), and two doctors came from a department of ultrasound and a department of pancreatic surgery.

The majority were male doctors ( $n = 11$ ) and only five were female doctors. They were from 33 to 53 years old (mean 40; SD 5) and had a median EUS experience of 5 years (range 1/2–20 years) and 2000 procedures (range 20–6000 procedures). Three KOLs performed only examinations, three performed examinations and biopsies,

but most performed both EUS examinations, biopsies, and therapeutic procedures ( $n = 10$ ).

#### *Participant's own learning experience as a trainee*

The most common way of preparing for learning EUS was reading textbooks and scientific papers (used by 81% of KOLs), followed by watching instructional videos (69% of KOLs). Three KOLs (19%) stated that they performed esophagogastroduodenoscopy and/or Endoscopic Retrograde Cholangio-Pancreatography specifically to prepare for EUS procedures. Interestingly, none of the 16 KOLs had used structured SBT to prepare for real-life EUS procedures. However, six KOLs (38%) attended dedicated EUS courses during their training, and these courses typically included hands-on training.

Three of the KOLs were self-taught EUS operators that started performing EUS as the first in their hospitals, *i.e.*, without access to supervision. However, the majority ( $n = 13$ ) was trained using the classical apprenticeship model where they spent a median of 1½ months (range 1 week to three years) observing a median of 90 cases (range 10–1200 cases) before they advanced to supervised performance on patients. The supervision consisted of 10–300 cases (median 50 cases) and lasted between 2 weeks and 2 years (median 2½ months). The 13 KOLs who had supervisors were considered ready for independent practice based on unstructured clinical observation; only three out of the 13 had formal assessment of their performance and two out of the 13 had a theoretical exam.

#### *Participant's experience as a supervisor*

Four of our participants could not answer questions regarding supervisor experience because they had not started training others ( $n = 3$ ) or did not allow trainees to have hands-on training ( $n = 1$ ). The remaining 12 KOLs had trained a median of 11 new EUS operators (range 2–500) and offered insights into their training methods. Most supervisors asked their trainees to prepare using textbooks (67%) and instructional videos (58%), but none of them demanded that their trainees practice on simulators before coming to the endoscopy suite. However, 42% of the KOLs sent their trainees to one or more dedicated EUS courses including hands-on training on phantoms at some point during their clinical training.

The KOLs used the classical apprenticeship model where they used median 2 months (range 1 week

to 6 months) to demonstrate a median of 30 procedures (range 5–150 procedures) before allowing their trainees to practice on patients. They supervised their trainees for median 3 months (range 1–9 months) and median 50 procedures (range 20–210 procedures) before they could perform EUS procedures independently. All supervisors used clinical observations to decide when their trainees are ready for independent practice, and only three out of 12 used structured assessment of their trainees to guide their decision.

#### *Participant's thoughts on current and future training*

Only five of the 16 KOLs were satisfied ( $n = 3$ ) or very satisfied ( $n = 2$ ) with the current apprenticeship EUS training, 5 were moderately satisfied, and 6 KOLs stated that they were not satisfied. Primarily, the KOLs complained that too many trainees combined with a lack of supervisors and resources for training resulted in too few hands-on training opportunities. Furthermore, several KOLs found it challenging that trainees had very different skills and attitudes, which made it necessary to arrange individualized training for each trainee – one size does not fit all. Specific concerns were trainees' lack of anatomical knowledge and their inferior ability to interpret ultrasound images. Some of the KOLs were concerned that trainees practicing on patients would slow down the procedure and might even decrease diagnostic yield and increase the complication rate.

The majority of the KOLs requested that SBT should be an integrated part of the EUS curriculum, but several complained that there is no available EUS simulator that realistically mimic human anatomy. Interestingly, several of the KOLs requested a complete EUS curriculum including standardized assessment of trainees and certification of future EUS operators.

## DISCUSSION

We interviewed 16 Chinese EUS operators to explore central tendencies regarding training and certification of the technique. Classical apprenticeship training continues to be the most frequent way of learning EUS, and hands-on training on simulators and phantoms is very rare done. Certification is not based on a structured assessment of skills. The majority of key-opinion leaders were not satisfied with the current EUS training opportunities, and several demanded a structured curriculum to include simulation and standardized assessment and certification of new EUS operators.

“See one, do one, teach one” is the traditional training model in medicine where the trainee begins by observing a more experienced colleague and proceeds to perform supervised procedures (*i.e.*, practices on patients) before being allowed to perform independently. This graduated approach toward helping trainees attain expertise and autonomy was established in the late 19<sup>th</sup> century by Sir William Halsted, but the rapid integration of more complex technologies in the world of medicine demands a more effective method to ensure that trainees can learn all the new skills.<sup>[11]</sup> EUS is a good example of an advanced procedure that is difficult to learn and the Chinese KOLs in this study expressed concerns regarding the trainee/supervisor ratio and the resources needed for this apprenticeship model to be a success. This concern aligns with multicenter studies that have found prolonged learning curves for EUS and a recent review of 1657 EUS procedures concluding that there was an increased risk of adverse events when procedures involved trainees in their first 3 months of training.<sup>[9,12,13]</sup>

SBT provides trainees ample opportunities to practice in a risk-free environment without the constant need of an experienced supervisor. Virtual-reality (VR) simulators can simulate many different patients, anatomical variations, and pathologies, and provide automatic metrics giving feedback to the unsupervised trainees. A randomized, international trial showed that practicing on an endobronchial VR simulator was more effective than apprenticeship training on patients.<sup>[14]</sup> Several of the KOLs in our study indicated that there are no realistic VR simulators available for EUS training. A good VR simulator could advance EUS training, but simulation-based hands-on training is also possible using specially developed physical phantoms or animal models, and structured training on these has shown promising results.<sup>[14-16]</sup>

The purpose of both SBT and the apprenticeship model is to ensure that all trainees reach an acceptable level of proficiency. Traditionally, a certain number of training months or performed supervised procedures is used to aid the important decision of when a trainee is ready for independent practice. The KOLs in our study supervised their trainees for median 3 months and 50 procedures, but more training might be necessary. A multicenter study showed that the average trainee required approximately 225 procedures to achieve competency in core EUS.<sup>[9]</sup> However, it is important to

acknowledge the substantial variability in time to achieve competence among trainees,<sup>[13]</sup> which was also found in our study where several KOLs reported challenges with trainees with very different skills and attitudes. In recent years, there has been a shift towards competency-based training and certification, and a systematic review from 2016 identified 30 studies regarding structured assessment of EUS competencies.<sup>[10]</sup> There is no shortage of assessment instruments, but the problem is the slow implementation of these for feedback and certification purposes. It is interesting to notice that very few of the KOLs in this study had been assessed using structured methods and that only three used these assessment instruments to certify their own trainees. International guidelines should continue to recommend that certification is based on an assessment of competencies instead of arbitrary numbers of training months or procedures performed.<sup>[17]</sup> Several of the KOLs in this study supported the shift towards competency-based education and addressed the need for standardized assessment of trainees and certification of future EUS operators.

Our study has several limitations. First, we used a very wide definition for “key-opinion leaders” because we wanted EUS operators at different stages of their career, including a few that were too inexperienced to be called KOL in the traditional sense. The interviews only represent the personal views of the selected 16 Chinese KOLs, and inclusion of more participants from other institutions and countries would have improved the generalizability of our findings. However, we strived to include KOLs from several hospitals in different cities and believe that our results are representative of EUS training conditions in China and many other countries. Furthermore, we did not perform a theory-based qualitative analysis of the opinions of the KOLs as the purpose was to provide a general overview and not an exhaustive report. Finally, it is important to acknowledge that this study focused on the individual and technical skills of the EUS operators and less on patient-related and team-related issues. Optimal preparation of the patients and clear clinical referral questions will increase the quality of the outcomes of EUS and are important points to remember in any training and certification program.<sup>[18]</sup> Similarly, future programs must not only focus on the individual endoscopist as mastery of EUS also depends on the practice environment and the multidisciplinary team members involved.<sup>[19]</sup>

## CONCLUSION

We found that EUS training and certification in China mainly follow the classical apprenticeship approach, but that many KOLs supported a shift towards structured SBT and certification based on a standardized assessment of competence. The leading experts in EUS should consider our findings when they plan future training programs and write guidelines on training and certification.

### *Supplementary materials*

Supplementary information is linked to the online version of the paper on the *Endoscopic Ultrasound* website.

### *Financial support and sponsorship*

Nil.

### *Conflicts of interest*

Lars Konge is an Editorial Board Member of the journal. The article was subject to the journal's standard procedures, with peer review handled independently of this editor and his research group.

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## APPENDIX A: INTERVIEW GUIDE

1. Name
  2. Age
  3. Sex
  4. Institute/location
  5. Department:
    - [1] Ultrasound
    - [2] Gastroenterology/Endoscopy
    - [3] GI Surgery
    - [4] Others (please specify):
  6. Years of EUS experience (approx.):
  7. Number of EUS procedures performed (approx.):
  8. Types of EUS procedures (check all that apply):
    - [1] examination
    - [2] biopsy
    - [3] treatment
  9. How did you learn EUS when you first started:
    - [1] Apprenticeship (*i.e.*, practicing on patients with a supervisor)
    - [2] Simulation
    - [3] Training course
    - [4] Others (please specify):
- If you learned EUS through an apprenticeship system,**
10. How many cases did your mentor demonstrate before he/she supervised you to perform EUS on patients?
  11. For how long did your mentor demonstrate before he/she let you perform EUS on patients supervised?
  12. How many cases did your mentor supervise before he/she allowed you to perform EUS independently?
  13. For how long did your mentor supervise before he/she allowed you to perform EUS independently?
  14. How did your mentor assess and confirm that you were qualified for independent EUS performance on patients?

**If you learned EUS through simulation,**

15. What type(s) of simulator(s) did you use?
16. How many cases did you practice on simulator before you perform EUS independently on patients?
17. For how long did you practice on simulator before you perform EUS independently on patients?
18. Were you assessed or qualified through a formal test before you performed EUS independently on patients?

**If you learned EUS through training course:**

19. How many training courses have you attended?
20. How long did those courses last on average?
21. Did they offer hands-on training?
22. Were you able to perform EUS independently on patients right after the course?
23. If you learned EUS through additional methods (i.e., reading, video learning), please briefly introduce how those helped you in learning EUS.
24. Do you train EUS doctors?
25. Approximately how many EUS doctors have you trained so far?
26. How do you train your EUS doctors?

[1] Apprenticeship (i.e., practicing on patients with a supervisor)

[2] Simulation

[3] Training course

[4] Others (please specify):

**If you train your trainees through an apprenticeship system,**

27. How many cases would you demonstrate before you supervise your trainees to perform EUS on patients?
28. For how long would you demonstrate before you supervise your trainees to perform EUS on patients?
29. How many cases would you supervise before you allowed your trainees to perform EUS independently?
30. For how long would you supervise before you allowed your trainees to perform EUS independently?
31. How did you assess and confirm that your trainees are qualified for independent EUS performance on patients?

**If you train your trainees through simulation,**

32. What type(s) of simulator(s) do you use?
33. How many cases would trainees practice on simulator, before performing EUS independently on patients?
34. For how long would trainees practice on simulator, before performing EUS independently on patients?
35. Are trainees assessed or qualified through a formal test before performing EUS independently on patients?

**If you train your trainees through training course:**

36. How many training courses would they generally attend?
37. How long would those courses last in average?
38. Do they offer hands-on training?
39. Are they able to perform EUS independently on patients right after the course?
40. If your trainees learned EUS through additional methods (i.e., reading, video learning), please briefly introduce how those helped them in learning EUS.
41. Are you satisfied with the EUS training modalities? If not, what exactly are you dissatisfied with? What do you think are the difficulties in EUS training? Do you have any suggestions regarding these dissatisfaction and difficulties? Are you willing to improve EUS training in the future?
42. Do you have more to add regarding EUS training?
43. Do you have any comments or suggestions on the contents of this interview?