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Effect of Standardized Teaching on Operational Proficiency and Complication Prevention among Young Physicians Performing Outpatient Painless Gastrointestinal Endoscopy

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Abstract: *Objective:* To evaluate the effect of standardized teaching on operational proficiency and complication prevention among young physicians performing outpatient painless gastrointestinal endoscopy. *Methods:* A total of 100 patients undergoing outpatient painless gastrointestinal endoscopy from January 2024 to January 2026 were included and randomly allocated to an observation group or a control group, with 50 patients in each group. Procedures in the control group were performed by young physicians who received traditional apprenticeship-based teaching, whereas procedures in the observation group were performed by young physicians who received standardized teaching. Procedure-level operational proficiency, complication incidence, patient satisfaction, and post-training theoretical and practical assessment scores were compared between the two groups. *Results:* Gastroscope insertion time, colonoscope insertion time, and examination completion time were significantly shorter in the observation group than in the control group, and the number of procedural errors was significantly lower (all $P < 0.001$). The overall incidence of complications was lower in the observation group than in the control group (4.00% vs. 18.00%, $P = 0.007$). Patient satisfaction was higher in the observation group than in the control group (96.00% vs. 80.00%, $P = 0.014$). Theoretical and practical assessment scores of young physicians were also significantly higher after standardized teaching (both $P < 0.01$). *Conclusion:* Standardized teaching can improve procedural proficiency, reduce complications, enhance patient satisfaction, and strengthen the comprehensive clinical competence of young physicians performing outpatient painless gastrointestinal endoscopy. This teaching model has practical value for clinical training.

Keywords: Outpatient; Painless gastrointestinal endoscopy; Standardized teaching; Young physicians; Operational proficiency; Complications

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1. Introduction

Painless gastrointestinal endoscopy is an important diagnostic and therapeutic technique in outpatient gastroenterology. Because it is minimally invasive, well tolerated, diagnostically accurate, and associated with rapid recovery, it is widely used for gastrointestinal disease screening, diagnosis, mucosal biopsy, and minimally invasive interventions such as polypectomy [1]. With the increasing demand for painless gastrointestinal endoscopy, higher requirements have been placed on physicians' procedural skills, safety awareness, and risk prevention capabilities.

Young physicians constitute an important reserve force in clinical practice, and the standardization of their procedural performance directly affects diagnostic quality, therapeutic efficiency, and patient safety. However, because of limited clinical experience and insufficient systematic training, young physicians may encounter difficulties such as non-standardized procedural steps, frequent operational errors, and inadequate awareness of complication prevention during independent practice. These issues can prolong examination time, increase patient discomfort, and create potential safety risks.

Traditional apprenticeship-based teaching is useful for clinical exposure, but it often lacks unified training procedures, standardized operational requirements, and quantitative assessment criteria. As a result, teaching outcomes may vary substantially according to the experience and teaching style of the supervising physician [2]. In contrast, standardized teaching is based on clinical training objectives and integrates theoretical instruction, simulation training, supervised practice, case review, and structured assessment. This approach may help young physicians master procedural principles, improve technical proficiency, and strengthen complication prevention and management. Therefore, this study investigated the effect of standardized teaching on the operational proficiency and complication prevention capabilities of young physicians performing outpatient painless gastrointestinal endoscopy.

2. Materials and methods

2.1. General information

A total of 100 patients who underwent painless gastrointestinal endoscopy in the outpatient gastroenterology department of our hospital between January 2024 and January 2026 were selected as study participants. Patients were randomly assigned to an observation group or a control group, with 50 patients in each group.

The inclusion criteria were as follows: (1) age 18–70 years; (2) meeting the indications for painless gastrointestinal endoscopy; (3) absence of contraindications to anesthesia; (4) provision of informed consent; and (5) completion of the procedure by young physicians with 1–3 years of clinical work experience who had not previously received systematic standardized training. The exclusion criteria were as follows: (1) severe cardiovascular or cerebrovascular disease, malignant tumor, immune system disease, or other serious systemic disease; (2) acute gastrointestinal perforation, massive hemorrhage, or other emergency conditions; (3) mental illness or inability to cooperate with the procedure; (4) pregnancy or lactation; and (5) inadequate bowel preparation or poor gastric emptying before examination.

There were no statistically significant differences in baseline patient characteristics between the two groups ($P > 0.05$), indicating that the groups were comparable (**Table 1**).

Table 1. Comparison of baseline patient characteristics between the two groups

Group	Sex(Male/Female, n)	Age(years)	Weight(kg)	ASA grade(I/II, n)
Observation group (n = 50)	28/22	48.36 ± 10.25	65.42 ± 8.75	32/18
Control group (n = 50)	26/24	47.89 ± 10.58	64.89 ± 9.12	30/20
t/χ^2 value	0.161	0.225	0.302	0.170
P value	0.688	0.822	0.763	0.680

Ten young physicians participated in this study. All were residents or visiting physicians with 1–3 years of work experience. They were randomly divided into two groups, with five physicians in each group. Physicians in the observation group received standardized teaching, whereas those in the control group received traditional apprenticeship-based teaching. The physicians in the two groups were responsible for the diagnosis and treatment of patients in the corresponding patient groups. There were no statistically significant differences in physician baseline characteristics, including sex, age, educational background, years of work experience, baseline theoretical score, and baseline practical score ($P > 0.05$), indicating comparability (**Table 2**).

Table 2. Comparison of baseline characteristics of young physicians between the two groups

Group	Sex (Male/Female)	Age (years)	Degree (B/M)	Working years	Baseline theoreticalscore	Baseline practicalscore
Observation group physicians (n = 5)	3/2	26.89 ± 1.56	3/2	1.89 ± 0.52	74.56 ± 4.89	73.89 ± 4.56
Control group physicians (n = 5)	2/3	27.12 ± 1.45	2/3	1.78 ± 0.48	75.12 ± 4.78	74.23 ± 4.32
t/χ^2 value	0.400	0.242	0.400	0.348	0.180	0.121
P value	0.527	0.815	0.527	0.737	0.861	0.907

2.2. Teaching methods

Physicians in the control group received traditional apprenticeship-based teaching under the guidance of senior attending physicians with more than 10 years of clinical experience in painless gastrointestinal endoscopy. Teaching mainly consisted of clinical demonstrations and oral explanations of precautions. Young physicians learned through observation and supervised practice. No unified teaching plan, standardized assessment criteria, systematic theoretical course, or simulation-based operational training was implemented.

Physicians in the observation group received standardized teaching under the guidance of senior attending physicians. A systematic teaching plan, unified operational standards, and a comprehensive assessment mechanism were established. The teaching period lasted 3 months and included four components. First, standardized theoretical training was conducted once weekly for 90 minutes and covered the basic principles of painless gastrointestinal endoscopy, equipment use, indications and contraindications, anesthesia-related medications, procedural steps, complication prevention and management, and doctor-patient communication. Typical cases and relevant expert consensus or guideline recommendations were incorporated to improve the authority and standardization of theoretical teaching. Second, simulation-based operational training was conducted twice weekly for 60 minutes per session. Different procedural scenarios and emergency responses to complications were simulated, and mentors provided on-site guidance and correction. Third, standardized clinical teaching was implemented after young physicians passed the simulation training. Clinical practice followed a stepwise principle from assistance to independent operation,

with full-process supervision, postoperative review, and summary. Each physician was required to complete at least 20 simulated operations and 30 supervised clinical procedures. Fourth, a structured assessment system integrating theory, operation, and clinical practice was established. Monthly staged assessments and a final assessment were conducted, and physicians who did not meet the required standard underwent supplementary training and re-examination.

2.3. Diagnostic and therapeutic procedures

All patients underwent standardized painless gastrointestinal endoscopy. Before the procedure, medical history and drug allergy history were reviewed, and routine blood tests, coagulation function tests, and electrocardiography were completed to assess the patient's physical status and anesthesia-related safety risks. Patients were informed of the procedure, potential risks, and relevant precautions, and informed consent was obtained.

For gastroscopy, patients were instructed to fast for 6 hours and abstain from water for 4 hours before the procedure. For colonoscopy, patients took polyethylene glycol electrolyte powder one day before the procedure for bowel preparation, and a Boston Bowel Preparation Scale score of ≥6 was required. Venous access was established before examination, and low-flow oxygen inhalation at 2–3 L/min was administered continuously. Vital signs were routinely monitored, and patients were placed in the left lateral position. Intravenous anesthesia was administered with sufentanil 5 μg combined with propofol 2 mg/kg. The procedure was initiated after adequate sedation was achieved and spontaneous breathing remained stable. Biopsy and polypectomy were performed when clinically indicated. After the procedure, patients were transferred to the recovery room for observation. Postoperative precautions were explained after consciousness and vital signs stabilized, and follow-up was conducted to identify and manage complications within 24 hours.

2.4. Observation indicators

(1) Operational proficiency: Gastroscope insertion time was defined as the time from insertion of the endoscope into the oral cavity to reaching the descending part of the duodenum. Colonoscope insertion time was defined as the time from insertion of the endoscope into the anus to reaching the ileocecal region. Examination completion time was defined as the time from onset of anesthesia to completion of the procedure. The number of procedural errors, including difficult insertion, mucosal injury, excessive or insufficient insufflation, and biopsy site deviation, was recorded.

(2) Complications: Complications occurring during the procedure and within 24 hours after the procedure were recorded, including nausea and vomiting, abdominal pain and bloating, pharyngeal injury, bleeding, and hypoxemia. The total incidence of complications was calculated.

(3) Patient satisfaction: Patient satisfaction was evaluated before discharge using a self-designed questionnaire. The questionnaire included four dimensions: procedural comfort, physician service attitude, diagnostic and therapeutic effect, and postoperative guidance. It contained 20 items, each scored from 1 to 5, with a total score of 100. Scores ≥90 were defined as very satisfied, scores of 70–89 as satisfied, and scores <70 as dissatisfied. Satisfaction rate was calculated as (number of very satisfied cases + number of satisfied cases) / total number of cases × 100%.

(4) Assessment scores of young physicians: After completion of the teaching period, theoretical and operational assessments were conducted for physicians in both groups. Each assessment was scored on a

100-point scale.

2.5. Statistical analysis

Data were analyzed using SPSS 27.0 statistical software. Measurement data are expressed as mean ± standard deviation (SD) and were compared using the independent-samples *t*-test. Count data are expressed as *n* (%) and were compared using the χ^2 test. Fisher's exact test was used when the expected frequency in any cell was less than 5. A two-sided *P* value < 0.05 was considered statistically significant.

3. Results

3.1. Operational proficiency

Procedure-level analysis showed that gastroscope insertion time, colonoscope insertion time, and examination completion time were significantly shorter in the observation group than in the control group. The number of procedural errors was also significantly lower in the observation group (all $P < 0.001$; **Table 3**).

Table 3. Comparison of procedure-level operational proficiency between the two groups

Group	Gastroscope insertion time(min)	Colonoscope insertion time(min)	Examination completion time(min)	Procedural errors (times/case)
Observation group (*n* = 50 procedures)	3.25 ± 0.58	5.36 ± 0.82	12.45 ± 1.63	0.32 ± 0.15
Control group (*n* = 50 procedures)	4.89 ± 0.76	7.92 ± 1.05	16.78 ± 2.15	1.56 ± 0.42
t value	12.218	13.604	11.350	19.425
P value	<0.001	<0.001	<0.001	<0.001

3.2. Complication incidence

The total incidence of complications was significantly lower in the observation group than in the control group (4.00% vs. 18.00%, $P = 0.007$; **Table 4**).

Table 4. Comparison of complications between the two groups

Group	Nausea/ vomiting(*n*)	Abdominal pain/ bloating(*n*)	Pharyngeal injury(*n*)	Bleeding (*n*)	Hypoxemia (*n*)	Total incidence [*n* (%)]
Observation group (*n* = 50)	1	1	0	0	0	2 (4.00)
Control group (*n* = 50)	4	3	2	1	1	11 (18.00)
χ^2 value	-	-	-	-	-	7.162
P value	-	-	-	-	-	0.007

3.3. Patient satisfaction

In the observation group, 32 patients were very satisfied, 16 were satisfied, and 2 were dissatisfied, yielding a satisfaction rate of 96.00%. In the control group, 22 patients were very satisfied, 18 were satisfied, and 10 were dissatisfied, yielding a satisfaction rate of 80.00%. Patient satisfaction was significantly higher in the observation group than in the control group ($\chi^2 = 6.061$, $P = 0.014$).

3.4. Assessment scores of young physicians

The theoretical and operational assessment scores of young physicians were significantly higher in the observation group than in the control group (both $P < 0.01$; **Table 5**).

Table 5. Comparison of assessment scores of young physicians between the two groups

Group	Theoreticalassessment score	Operationalassessment score
Observation groupphysicians ($n = 5$)	89.65 ± 4.28	90.32 ± 3.85
Control groupphysicians ($n = 5$)	75.32 ± 5.16	74.89 ± 4.62
t value	4.784	5.736
P value	0.002	<0.001

4. Discussion

Painless gastrointestinal endoscopy has become a routine outpatient diagnostic and therapeutic technique. The standardization and proficiency of physicians' procedures directly affect diagnostic quality, therapeutic efficiency, and medical safety [3,4]. Young physicians often have limited practical experience and may show insufficient procedural standardization, weak emergency response ability, and inadequate complication prevention awareness. These deficiencies can increase examination time, procedural errors, and adverse events, ultimately affecting the patient experience. Traditional apprenticeship-based teaching remains valuable in clinical education, but its effectiveness depends heavily on the experience, time investment, and teaching style of individual supervisors. The lack of a unified syllabus, standardized operational pathway, and objective assessment system may lead to inconsistent training outcomes [5].

The present study showed that standardized teaching significantly improved procedure-level operational proficiency. Compared with traditional teaching, standardized teaching was associated with shorter gastroscope insertion time, colonoscope insertion time, and total examination time, as well as fewer procedural errors. This improvement may be explained by several factors. First, systematic theoretical training helped young physicians clarify procedural principles, indications, contraindications, equipment use, and safety requirements. Second, simulation-based training provided repeated practice in a low-risk environment and reduced the uncertainty and anxiety associated with real clinical operations. Third, supervised clinical teaching allowed instructors to correct non-standard movements and procedural habits in real time. Finally, staged assessments created continuous feedback and encouraged physicians to consolidate both theoretical knowledge and practical skills.

Complication prevention and management are essential components of painless gastrointestinal endoscopy. Common adverse events such as nausea and vomiting, abdominal discomfort, pharyngeal injury, bleeding, and hypoxemia may be related to procedural technique, patient tolerance, sedation depth, and perioperative monitoring [7]. In this study, the complication rate was significantly lower in the standardized teaching group than in the traditional teaching group. This finding suggests that standardized teaching can improve the risk prevention and control capabilities of young physicians. The standardized teaching program included targeted training on complication mechanisms, prevention measures, emergency response, gentle endoscopic manipulation, standardized biopsy procedures, and continuous monitoring during sedation. These measures may reduce adverse events through improvements in both technical performance and safety awareness.

Patient satisfaction is an important indicator of medical service quality and is influenced by procedural comfort, communication quality, examination efficiency, and the occurrence of complications [4,6]. The satisfaction rate in the observation group was 96.00%, which was significantly higher than the 80.00% observed in the control group. Standardized teaching may improve satisfaction by shortening procedure time, reducing discomfort, improving communication before and after examination, and lowering complication rates. In addition, structured training in doctor-patient communication may help young physicians explain the examination process more clearly and reduce preoperative anxiety, thereby improving the overall patient experience [8,9].

Theoretical and practical assessment scores further supported the effectiveness of standardized teaching. Physicians in the standardized teaching group achieved higher post-training scores than those in the traditional teaching group. Traditional teaching often emphasizes observation and experience accumulation but may be insufficient in structured knowledge delivery and objective feedback [2,10]. In contrast, standardized teaching combines theoretical instruction, simulation training, supervised clinical practice, and quantitative assessment. This model promotes the integration of knowledge and practice and may accelerate the transition of young physicians from assisted practice to more independent procedural competence.

This study has several limitations. First, it was a single-center study with only 100 patients and 10 young physicians, which limits the generalizability of the findings. Second, the teaching period lasted only 3 months, and only short-term training effects were evaluated; long-term retention of procedural skills remains to be confirmed. Third, patient satisfaction was assessed using a self-designed questionnaire, and future studies should consider using validated satisfaction instruments. Fourth, the study mainly focused on procedural efficiency, common complications, and assessment scores, whereas diagnostic accuracy, quality of mucosal observation, and competence in complex therapeutic endoscopy were not fully evaluated. Future multicenter studies with larger sample sizes, longer follow-up, and more comprehensive outcome measures are needed to further validate and optimize this standardized teaching model.

5. Conclusion

In conclusion, standardized teaching can improve the operational proficiency of young physicians performing outpatient painless gastrointestinal endoscopy, reduce complications, improve patient satisfaction, and enhance theoretical and practical competence. This approach helps address the limitations of traditional apprenticeship-based teaching and has practical value for clinical training. Continuous refinement of teaching content according to updated clinical guidelines and technological development may further improve the quality and safety of outpatient gastrointestinal endoscopy services.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Shaukat A, Kahi CJ, Burke CA, et al., 2021, ACG Clinical Guidelines: Colorectal Cancer Screening 2021. Am J Gastroenterol, 116(3): 458–479.

[2] Aydin A, Ahmed K, Abe T, et al., 2022, Effect of Simulation-Based Training on Surgical Proficiency and Patient Outcomes: A Randomised Controlled Clinical and Educational Trial. Eur Urol, 81(4): 385–393.

[3] Bretthauer M, Loberg M, Wieszczy P, et al., 2022, Effect of Colonoscopy Screening on Risks of Colorectal Cancer and Related Death. N Engl J Med, 387(17): 1547–1556.

[4] Sidhu R, Turnbull D, Newton M, et al., 2024, British Society of Gastroenterology Guidelines on Sedation in Gastrointestinal Endoscopy. Gut, 73: 1–27.

[5] Tozsin A, Ucmak H, Soyturk S, et al., 2024, The Role of Artificial Intelligence in Medical Education: A Systematic Review. Surg Innov, 31(4): 415–423.

[6] Tomaszewski M, Sanders D, Enns R, et al., 2021, Risks Associated with Colonoscopy in a Population-Based Colon Screening Program: An Observational Cohort Study. CMAJ Open, 9(4): E940–E947.

[7] Costantino A, Bortoluzzi F, Giuffre M, al., 2021, Correct Use of Telemedicine in Gastroenterology, Hepatology, and Endoscopy During and After the COVID-19 Pandemic: Recommendations from the Italian Association of Hospital Gastroenterologists and Endoscopists (AIGO). Dig Liver Dis, 53(10): 1221–1227.

[8] Gellad ZF, Diamond S, Crockett SD, et al., 2023, AGA Clinical Practice Update on Telemedicine in Gastroenterology: Commentary. Gastroenterology, 165(3): 706–715.

[9] Cortellini F, Fichera A, Guarino AD, et al., 2025, Abdominal and Bowel Ultrasound Knowledge Among Young Gastroenterologists: Results of an Italian Survey. J Clin Med, 14(8): 2693.

[10] Yanik E, Intes X, Kruger U, et al., 2021, Deep Neural Networks for the Assessment of Surgical Skills: A Systematic Review. arXiv. arXiv:2103.05113.