Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Learning from patient safety incidents: development and evaluation of a case- based non-technical skills curriculum in obstetric anaesthesia

Quexuan Cui
Peking Union Medical College Hospital
Yu Zhang
Peking Union Medical College Hospital
Lingeer Wu
Peking Union Medical College Hospital
Yahong Gong
Peking Union Medical College Hospital
Xue Zhang
zhangxuepumch@126.com

Peking Union Medical College Hospital

Research Article

Keywords: case-based learning, non-technical skills, obstetric anaesthesia, labour analgesia, patient safety, medical education

Posted Date: September 25th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11026708/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Non-technical skills (NTS), including professionalism, humanistic care, clinical communication, and medico-legal awareness, are essential in obstetric anaesthesia but are often underemphasised in technical training. Real-world patient safety incidents retain the clinical, organisational, and interpersonal context in which preventable risk emerges, making them valuable for NTS education. We developed a case-based learning (CBL) module using anonymised patient safety incidents to integrate clinical management with communication, humanistic care, and professional responsibility.

Methods

In this prospective, single-centre, pre-post study, postgraduate year 3 (PGY3) residents and post-residency physicians attended a CBL session. Members of the patient safety incident management team screened obstetric-related cases recorded in the database from 2017 to 2025; selected cases addressed labour analgesia complications and a medico-legal dispute. Paired 5-point Likert questionnaires assessed self-reported competence and attitudes across four NTS domains. Paired tests assessed pre-course/post-course changes; exploratory analyses examined differences by session and training status.

Results

Fifty of 54 invited participants completed both questionnaires (92.6%). Most items across the four NTS domains improved significantly. The largest gain was in understanding core Civil Code medical-liability provisions (mean ± standard deviation (SD), 2.50 ± 0.95 before to 3.60 ± 1.03 after; $p < 0.001$). Improvement was smaller in Session 1, which did not include the medico-legal case (0.46 ± 1.22), than in Session 2, in which Case 5 was added after written student feedback (1.69 ± 1.44; $p = 0.002$). PGY3 participants demonstrated greater gains than post-residency physicians in several communication and medico-legal items.

Conclusions

A CBL module based on obstetric anaesthesia patient safety incidents was associated with improved self-reported NTS competence and professional attitudes. Integrating humanistic, ethical, and medico-legal content into case-based clinical education may be feasible before the transition to independent practice. Larger studies with objective and longitudinal outcomes are needed.

Trial registration

Not applicable. This study evaluated an educational intervention and did not involve a healthcare intervention trial.

Background

Pain relief is essential to high-quality obstetric care. Labour epidural analgesia (LEA), administered by anaesthesiologists, is one of the most effective interventions for relieving labour pain[1, 2]. During LEA, women experience not only pain from uterine contractions but also profound psychological changes as they transition to motherhood and face the fear of the unknown. Consequently, the demand for well-developed non-technical skills (NTS) in the obstetric suite is particularly high[3, 4]. Anaesthesiologists must manage complex situations, including breakthrough pain and emergency intrapartum caesarean delivery, while making rapid clinical decisions, coordinating with the team, and communicating empathetically and clearly to support informed consent[5]. These high-stakes, dynamic situations underscore the importance of NTS for patient safety and high-quality care and highlight the need to move training beyond technical proficiency alone.

In recent years, the use of LEA in China has increased substantially. At our institution, residents in the later stages of training are permitted to perform neuraxial analgesia under applicable supervision and credentialing requirements. Once technical proficiency has been achieved, training should also address non-technical aspects of practice, including humanistic care, doctor-patient communication, professional responsibility, and medico-legal literacy. These competencies are particularly important in labour analgesia. However, traditional residency training often emphasises routine surgical scenarios, leaving a gap in structured instruction tailored to the professional and humanistic challenges of labour analgesia.

Case-based learning (CBL) offers a practical way to address this educational gap and has been used effectively in medical curricula[6, 7]. CBL is particularly well suited to real patient safety incidents, which provide a concrete starting point for examining the complexity of clinical practice[8, 9]. Compared with hypothetical vignettes, real-world incidents retain the temporal, organisational, and interpersonal context in which harm or near harm occurred, including escalation, disclosure, documentation, and follow-up. This contextual detail is especially important for NTS education because preventable risk often emerges from interactions among technical actions, communication, team coordination, and local systems rather than from a single clinical error. In this curriculum, patient safety incidents were not merely illustrative cases but the central educational material for examining clinical management, communication, teamwork, professionalism, and system factors without reducing the analysis to individual blame. By asking not only what happened but also how clinical decisions, communication, teamwork, and system factors contributed to the outcome, learners can translate lessons from past incidents into preventive strategies. When combined with role-play and scenario-based simulation, CBL creates a safe but realistic environment for practising complex communication tasks and fostering empathy and emotional intelligence[10–12].

The purpose of this study was to evaluate whether a specialised CBL curriculum integrating humanistic care and professionalism was associated with improvements in self-reported NTS competence, professional attitudes, and medico-legal awareness among participants who were either in late-stage residency training or had completed standard residency training. We used paired pre-course and post-course questionnaires to assess changes in professional knowledge and humanistic attitudes.

Methods

Study design

This was a prospective, single-centre, pre-post educational intervention study. The study aimed to develop and evaluate a curriculum for anaesthesiology trainees and physicians based on patient safety incidents related to labour analgesia and obstetric anaesthesia. The curriculum was delivered in the Department of Anaesthesiology at Peking Union Medical College Hospital (PUMCH). Paired pre-course and post-course questionnaires were used to evaluate changes in participants' self-perceived competence and attitudes before and after the course. The study was approved by the Research Ethics Committee of Peking Union Medical College Hospital (PUMCH; approval no. I-26PJ1603).

Participants

Participants were anaesthesiology trainees and physicians at PUMCH. Eligible participants were either postgraduate year 3 (PGY3) residents or physicians who had completed standard residency training, attended the teaching session, and completed both questionnaires. Participants who did not complete the full teaching session or who had incomplete pre-course or post-course questionnaires were excluded from the analysis.

Curriculum development

The curriculum was developed from real patient safety incidents recorded in the department's quality-control database. Members of the department's patient safety incident management team screened obstetric-related cases recorded in the database from 2017 to 2025 and selected cases relevant to labour analgesia and obstetric anaesthesia for curriculum development. The selected cases included accidental dural puncture (ADP), accidental subarachnoid catheterisation, incorrect removal of an epidural catheter, post-dural puncture headache, and an ADP-related caesarean case involving intracranial venous thrombosis. Using de-identified cases from this patient safety incident database preserved clinical authenticity, highlighted locally relevant risks and workflows, and supported reflection on preventable factors and practical responses. A detailed summary of the cases and their associated learning objectives is presented in Fig. 1. Identifiable patient information, physician names, and other personal identifiers were removed from all cases used for teaching.

Educational intervention

To ensure instructional consistency, participating faculty members from obstetric anaesthesia and residency education attended collaborative sessions to standardise case presentations, discussion prompts, and learning objectives. Each teaching session used an interactive format combining CBL and group discussion. Faculty first presented the cases. Participants then worked in small groups to identify

clinical risks and communication challenges. Finally, faculty led a structured debriefing that integrated clinical guidelines and institutional workflows with NTS. After Session 1, the teaching team reviewed students' comments in the post-course questionnaires. In response to requests for additional medico-legal content, the medico-legal case (Case 5) was added to Session 2.

Questionnaire design and analysis

The questionnaires were administered in Chinese; an English translation is provided in Additional file 1. A 5-point Likert scale was used to assess self-reported competence and attitudes in four primary domains: Professionalism and Responsibility, Humanistic Care, Clinical Communication, and Medico-legal Awareness. A separate multiple-selection item set assessed participants' perceptions of the responsibilities of obstetric anaesthesiologists. The surveys also collected baseline demographic data, prior patient safety incident exposure, and prior communication difficulties.

All questionnaires were completed anonymously and matched using unique, non-identifying codes for paired analysis. Participants were assured that participation was voluntary and would not influence their training evaluations or performance reviews.

Sample size

This was a single-centre exploratory educational study using convenience sampling. All 54 eligible participants at the study centre were invited to participate. Fifty completed both the pre-course and post-course questionnaires and were included in the analysis, corresponding to a participation rate of 92.6%. The remaining four invitees did not complete both questionnaires. No formal sample size calculation was performed because the study was designed as a preliminary evaluation of the educational effectiveness of the course.

Statistical analysis

Quantitative analyses were performed using IBM SPSS Statistics version 30.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarised as means ± standard deviations (SDs) or medians with interquartile ranges (IQRs), as appropriate; distributional assumptions were assessed using the Shapiro-Wilk test. Pre-course and post-course Likert scores were compared using paired-samples t-tests or Wilcoxon signed-rank tests, as appropriate. Between-group comparisons by training status were performed using independent-samples t-tests or Mann-Whitney U tests. Paired binary responses to the multiple-selection items were analysed using McNemar tests, and independent categorical variables were compared using chi-square or Fisher's exact tests. All tests were two-tailed, with statistical significance set at $p < 0.05$.

Use of generative AI

After the study and analyses were completed, OpenAI Codex was used to assist with English-language editing and journal-specific formatting. The authors reviewed all changes and take full responsibility for the content of the manuscript.

Results

Participant characteristics

A total of 50 participants completed both the pre-course and post-course questionnaires. Baseline demographic and clinical-experience characteristics are summarised in Table 1. Among the 50 participants, 35 (70.0%) were female and 15 (30.0%) were male. Eighteen participants (36.0%) were current PGY3 residents, and 32 (64.0%) had completed standard residency training. The first teaching session included 24 (48.0%) participants, and the second included 26 (52.0%). All participants reported prior clinical experience with labour analgesia or neuraxial anaesthesia for caesarean delivery, and 44 (88.0%) reported having performed more than 20 procedures. In addition, 47 (94.0%) reported prior obstetric anaesthesia training. More than half had previously encountered labour analgesia-related patient safety incidents (27/50, 54.0%) or doctor-patient communication difficulties (31/50, 62.0%).

Table 1
Demographic and baseline characteristics of study participants (N = 50)

Characteristic	Category	n	%
Gender	Female	35	70.0%
	Male	15	30.0%
Residency Training Status	PGY3	18	36.0%
	Completed residency training	32	64.0%
Class Session	Session 1 (Standard CBL)	24	48.0%
	Session 2 (CBL + Legal cases)	26	52.0%
Prior Clinical Experience	Yes	50	100.0%
	No	0	0.0%
Number of Prior Procedures	≤ 20 cases	6	12.0%
	> 20 cases	44	88.0%
Prior Obstetric Anaesthesia Training	Yes	47	94.0%
	No	3	6.0%
Encountered Prior Patient Safety Incidents	Yes	27	54.0%
	No	23	46.0%
Encountered Prior Communication Issues	Yes	31	62.0%
	No	19	38.0%

PGY, postgraduate year; CBL, case-based learning.

Overall educational outcomes

Paired pre-course and post-course analysis showed statistically significant increases in most self-reported NTS items after the curriculum (Table 2). Participants reported significant improvements in Professionalism and Responsibility (for example, active learning of complication management, item 2–3, $p < 0.001$), Humanistic Care (for example, protecting patient privacy, item 3 − 2, $p < 0.001$), and Clinical Communication (for example, risk disclosure, item 4 − 1, $p < 0.001$). The largest absolute increase was observed for Medico-legal Awareness item 5 − 1, concerning the core medical-liability provisions of the Civil Code, which increased from 2.50 ± 0.95 before the course to 3.60 ± 1.03 after the course ($p < 0.001$).

Table 2
Self-reported non-technical competence and responsibility attitudes before and after the course (N = 50)

Domain	Question summary	Pre-course	Post-course	p value
Responsibilities	Rapid neuraxial puncture (1–1)	44 (88.0%)	48 (96.0%)	0.289
	Patient safety (1–2)	50 (100.0%)	50 (100.0%)	-
	Psychological support (1–3)	44 (88.0%)	47 (94.0%)	0.508
	Records and event reporting (1–4)	34 (68.0%)	43 (86.0%)	0.093
Professionalism	Life-guardian role (2 − 1)	4.68 ± 0.51	4.98 ± 0.14	< 0.001
	Safety-first attitude (2–2)	4.90 ± 0.30	4.98 ± 0.14	0.103
	Complication learning (2–3)	4.58 ± 0.57	4.96 ± 0.20	< 0.001
	SOP compliance (2–4)	4.70 ± 0.51	5.00 ± 0.00	< 0.001
	Seek help for difficult puncture (2–5)	4.70 ± 0.54	4.92 ± 0.27	0.010
	Report complications (2–6)	4.74 ± 0.63	4.94 ± 0.24	0.049
Humanistic care	Comfort psychological distress (3 − 1)	4.60 ± 0.57	4.94 ± 0.24	< 0.001
	Protect patient privacy (3 − 2)	4.46 ± 0.79	4.90 ± 0.30	< 0.001
	Personalised care (3–3)	4.48 ± 0.74	4.90 ± 0.30	< 0.001
	Avoid dissatisfaction-inducing language (3–4)	4.28 ± 0.70	4.96 ± 0.20	< 0.001
	Maternal-infant safety focus (3–5)	4.76 ± 0.56	4.98 ± 0.14	0.010
Communication	Explain risks and cooperation (4 − 1)	4.22 ± 0.65	4.72 ± 0.45	< 0.001
	Disclose patient safety incidents (4 − 2)	4.38 ± 0.73	4.90 ± 0.42	< 0.001
	Empathic response (4 − 3)	4.52 ± 0.65	4.90 ± 0.30	< 0.001

Values are presented as n (%) or mean ± SD. Paired binary responses were compared using McNemar tests; paired Likert responses were compared using paired-samples t-tests or Wilcoxon signed-rank tests, as appropriate. SOP, standard operating procedure; SD, standard deviation.

For item 5 − 1, the two additional rows report within-session pre-course to post-course scores: Session 1 did not include Case 5 (p = 0.430), whereas Case 5 was added to Session 2 after written student feedback requesting more medico-legal content (p < 0.001).

Domain	Question summary	Pre-course	Post-course	p value
	Explain follow-up and prognosis (4–4)	4.06 ± 0.79	4.80 ± 0.45	< 0.001
	Communication reduces disputes (4–5)	4.66 ± 0.59	4.96 ± 0.20	< 0.001
Medico-legal awareness	Civil Code liability clauses (5 – 1)	2.50 ± 0.95	3.60 ± 1.03	< 0.001
	5 – 1: Session 1	2.58 ± 0.88	3.04 ± 1.00	0.430
	5 – 1: Session 2	2.42 ± 1.03	4.12 ± 0.77	< 0.001
	Consent is not a liability waiver (5 – 2)	4.20 ± 0.86	4.64 ± 0.63	0.007
	Complete medical records (5 – 3)	4.48 ± 0.61	4.86 ± 0.40	0.001
	Liability criteria for complications (5 – 4)	3.62 ± 0.97	4.64 ± 0.63	< 0.001
	Report patient safety incidents promptly (5–5)	4.68 ± 0.62	4.92 ± 0.27	0.013

Values are presented as n (%) or mean ± SD. Paired binary responses were compared using McNemar tests; paired Likert responses were compared using paired-samples t-tests or Wilcoxon signed-rank tests, as appropriate. SOP, standard operating procedure; SD, standard deviation.

For item 5 – 1, the two additional rows report within-session pre-course to post-course scores: Session 1 did not include Case 5 (p = 0.430), whereas Case 5 was added to Session 2 after written student feedback requesting more medico-legal content (p < 0.001).

Comparison between teaching sessions

To assess whether score changes differed between the two teaching sessions, we compared the change scores (delta, post-course minus pre-course score). For the three core NTS domains of Professionalism and Responsibility, Humanistic Care, and Clinical Communication, no statistically significant between-session differences were observed (all p > 0.05; see Additional file 2). A significant between-session difference was observed for Medico-legal Awareness (Table 3). Session 1 (n = 24) did not include the medico-legal case (Case 5), whereas Case 5 was added to Session 2 (n = 26) in response to students' comments in the Session 1 post-course questionnaires. Accordingly, the improvement in understanding the Civil Code provisions regarding medical liability was smaller in Session 1 than in Session 2 (Session 1: 0.46 ± 1.22; Session 2: 1.69 ± 1.44; p = 0.002). This comparison should be interpreted as an exploratory comparison of two implementation conditions rather than as a randomised test of the effect of Case 5 alone.

Table 3
Comparison of improvement in medico-legal awareness between teaching sessions

Question summary	Session 1 (n = 24)	Session 2 (n = 26)	p value
Civil Code liability clauses (5 − 1)	0.46 ± 1.22	1.69 ± 1.44	0.002
Consent is not a liability waiver (5 − 2)	0.29 ± 1.16	0.58 ± 1.06	0.369
Complete medical records (5 − 3)	0.33 ± 0.92	0.42 ± 0.64	0.689
Liability criteria for complications (5 − 4)	0.96 ± 1.04	1.08 ± 0.98	0.680
Report patient safety incidents promptly (5–5)	0.33 ± 0.70	0.15 ± 0.61	0.339

Values are presented as mean ± SD of post-course minus pre-course scores. Session 1 did not include Case 5, and Case 5 was added to Session 2 in response to written student feedback. SD, standard deviation.

Comparison by training status

To explore when NTS training might be integrated into residency education, we compared change scores between current PGY3 residents (n = 18) and participants who had completed standard residency training (n = 32; Table 4). The PGY3 group showed significantly greater gains in active learning of complication management (item 2–3, 0.78 ± 0.65 vs. 0.16 ± 0.52, $p < 0.001$), providing personalised anaesthesia services (item 3–3, $p = 0.011$), and several Clinical Communication items, including risk disclosure (item 4 − 1, 1.06 ± 0.73 vs. 0.19 ± 0.74, $p < 0.001$), proactive communication after patient safety incidents (item 4 − 2, $p = 0.002$), and explanation of follow-up plans (item 4–4, $p = 0.008$). In the Medico-legal Awareness domain, PGY3 participants also showed significantly greater improvements in understanding Civil Code provisions (item 5 − 1, $p = 0.038$), recognising the legal limits of informed consent (item 5 − 2, $p = 0.030$), standardising medical records (item 5 − 3, $p = 0.001$), and reporting patient safety incidents (item 5–5, $p = 0.034$).

Table 4
Comparison of score improvements by training status

Domain	Question summary	Completed residency (n = 32)	Current PGY3 residents (n = 18)	p value
Professionalism	Life-guardian role (2 − 1)	0.25 ± 0.51	0.39 ± 0.61	0.392
	Safety-first attitude (2–2)	0.00 ± 0.25	0.22 ± 0.43	0.025
	Complication learning (2–3)	0.16 ± 0.52	0.78 ± 0.65	< 0.001
	SOP compliance (2–4)	0.22 ± 0.42	0.44 ± 0.62	0.131
	Seek help for difficult puncture (2–5)	0.25 ± 0.57	0.17 ± 0.62	0.632
	Report complications (2–6)	0.06 ± 0.44	0.44 ± 0.98	0.063
Humanistic care	Comfort psychological distress (3 − 1)	0.31 ± 0.59	0.39 ± 0.50	0.647
	Protect patient privacy (3 − 2)	0.41 ± 0.76	0.50 ± 0.71	0.669
	Personalised care (3–3)	0.22 ± 0.66	0.78 ± 0.81	0.011
	Avoid dissatisfaction-inducing language (3–4)	0.63 ± 0.71	0.78 ± 0.81	0.490
	Maternal-infant safety focus (3–5)	0.13 ± 0.49	0.39 ± 0.70	0.125
Communication	Explain risks and cooperation (4 − 1)	0.19 ± 0.74	1.06 ± 0.73	< 0.001
	Disclose patient safety incidents (4 − 2)	0.28 ± 0.52	0.94 ± 0.94	0.002
	Empathic response (4 − 3)	0.28 ± 0.63	0.56 ± 0.62	0.145
	Explain follow-up and prognosis (4–4)	0.47 ± 0.84	1.22 ± 1.06	0.008
	Communication reduces disputes (4–5)	0.22 ± 0.55	0.44 ± 0.62	0.190
Medico-legal awareness	Civil Code liability clauses (5 − 1)	0.78 ± 1.41	1.67 ± 1.41	0.038
	Consent is not a liability waiver (5 − 2)	0.19 ± 1.00	0.89 ± 1.18	0.030

Values are presented as mean ± SD of post-course minus pre-course scores. PGY3, postgraduate year 3; SD, standard deviation.

Domain	Question summary	Completed residency (n = 32)	Current PGY3 residents (n = 18)	p value
	Complete medical records (5 − 3)	0.13 ± 0.71	0.83 ± 0.71	0.001
	Liability criteria for complications (5 − 4)	0.84 ± 0.99	1.33 ± 0.97	0.097
	Report patient safety incidents promptly (5–5)	0.09 ± 0.53	0.50 ± 0.79	0.034

Values are presented as mean ± SD of post-course minus pre-course scores. PGY3, postgraduate year 3; SD, standard deviation.

Discussion

This study evaluated a CBL curriculum developed from real-world patient safety incidents in labour analgesia and obstetric anaesthesia. The patient safety incident itself served as the organising educational unit: learners traced how technical management, communication, teamwork, professional duties, and system conditions interacted before identifying preventive actions. The principal finding was that integrating clinical management, medical ethics, and legal responsibilities into a single educational framework was associated with improved self-reported NTS competence and professional attitudes among participants in late-stage training or after residency.

Using real-world patient safety incidents strengthened the curriculum in several ways. The cases preserved the sequence of care, local workflows, and communication demands that are difficult to reproduce in generic vignettes. They also allowed learners to examine how an initially technical complication could extend into disclosure, documentation, follow-up, and medico-legal responsibilities. Reviewing incidents within a no-blame, systems-oriented framework may help clinicians regard incident reporting as a source of collective learning rather than solely as an administrative or punitive process. In addition, the departmental screening process linked the curriculum to risks encountered in local practice, making the content immediately relevant to participants.

Traditional residency programmes often separate technical skills, such as epidural puncture, from NTS. Our findings support the use of a unified, case-based approach to connect these domains. In obstetric anaesthesia, where clinical situations are dynamic and patient interactions are emotionally charged, communication, ethical decision-making, and medico-legal literacy are important components of clinical safety and patient-centred care[13, 14].

Students' comments in the Session 1 post-course questionnaires requested additional medico-legal content. We therefore added Case 5 to Session 2. The improvement in participants' understanding of Civil Code provisions on medical liability was smaller in Session 1 than in Session 2 (Session 1: 0.46 ± 1.22; Session 2: 1.69 ± 1.44; p = 0.002). This finding suggests that complication-management training

alone may not ensure adequate understanding of related legal responsibilities. Topics such as the legal boundaries of informed consent, documentation standards, and reporting obligations should nevertheless be taught explicitly through focused legal analysis.

Subgroup analysis showed that current PGY3 participants experienced significantly greater improvements in several NTS items than participants who had completed residency training. This pattern may reflect higher baseline scores and a ceiling effect among more experienced clinicians, as well as the immediate relevance of independent practice for PGY3 residents. PGY3 may therefore be a useful time point for introducing or reinforcing NTS training before the transition to more autonomous practice. This interpretation should be tested in larger, multicentre studies with objective behavioural outcomes.

Obstetric anaesthesia is distinctive because patients experience intense physiological pain while navigating a profound life transition. Humanistic care is therefore not merely an auxiliary soft skill; it is central to patient safety and the therapeutic relationship. In this study, participants reported improved commitment to protecting patient privacy during invasive procedures (item 3 − 2, $p < 0.001$) and improved self-reported empathetic communication.

Rather than relying on isolated lectures on ethics or communication, our curriculum embedded professional values and humanistic care in case-based analysis. By examining real-world patient safety incidents and discussing the associated ethical, legal, and clinical duties, participants could connect empathy and professional accountability with everyday practice. Because these incidents originated in routine care rather than being constructed around a single learning objective, they also exposed ambiguity, competing priorities, and incomplete information. Working through that complexity may help learners connect early recognition and escalation with transparent disclosure, longitudinal follow-up, documentation, and institutional reporting. This approach is consistent with contemporary concepts of professional identity formation and may facilitate authentic development of NTS[15, 16].

This study has several limitations. First, it was conducted at a single centre with a relatively small sample size, which may limit the generalisability of the findings. Second, the assessment relied on self-reported questionnaires rather than objective measures of clinical behaviour; self-reported ratings may overestimate competence. Third, only the immediate post-intervention effects were measured, so the long-term retention of NTS and any effect on clinical complications or medical disputes remain unknown. Fourth, the incident cases were drawn from a single departmental database and selected by members of the patient safety incident management team. The curriculum may therefore reflect local reporting practices, case availability, and selection judgement, while unreported incidents were not represented. Finally, the comparison between teaching sessions was not randomised, and Case 5 was added after Session 1 in response to student feedback; the resulting difference in content limits causal interpretation of the between-session comparison.

Conclusions

In conclusion, a CBL curriculum derived from real-world patient safety incidents was associated with improved self-reported NTS competence and professional attitudes in obstetric anaesthesia education. Positioning patient safety incidents as educational material may help transform locally experienced safety problems into structured learning about prevention, disclosure, follow-up, and professional accountability. PGY3 may represent a useful time point for this training, particularly before the transition to more autonomous practice. Integrating professional values, ethical duties, and medico-legal responsibilities into case-based clinical learning provides a feasible framework for NTS education that warrants further evaluation using objective and longitudinal outcomes.

Abbreviations

ADP
accidental dural puncture
CBL
case-based learning
CSEA
combined spinal-epidural anaesthesia
IQR
interquartile range
LEA
labour epidural analgesia
NTS
non-technical skills
PGY3
postgraduate year 3
PUMCH
Peking Union Medical College Hospital
SD
standard deviation
SOP
standard operating procedure.

Declarations

Ethics approval and consent to participate

The study was approved by the Research Ethics Committee of Peking Union Medical College Hospital (PUMCH; approval no. I-26PJ1603). Because the study involved no direct contact with patients and all case materials were fully anonymised before use, the requirement for patient informed consent was waived by the Committee. Participation in the educational evaluation was voluntary, and all questionnaires were completed anonymously.

Consent for publication

Not applicable. The manuscript contains no individual participant data, images, or videos that could identify a person.

Availability of data and materials

The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request. Access may be subject to institutional approval because the dataset derives from an educational evaluation.

Competing interests

The authors declare that they have no competing interests.

Funding

This work was supported by the Teaching Reform Project on Integrating Ideological and Political Education into the Curriculum at Peking Union Medical College (Grant No. 2025kcsz002). The funder had no role in the design of the study, data collection, analysis, interpretation of data, or writing of the manuscript.

Authors' contributions

QC and XZ conceived the study. QC, YZ, LW, YG, and XZ contributed to curriculum development and data collection. QC analysed the data and drafted the manuscript. All authors contributed to interpretation of the findings, critically revised the manuscript, and approved the final version.

Acknowledgements

The authors thank all participants who took part in the educational evaluation.

Authors' information

Not applicable.

References

1. American Society of Anesthesiologists Task Force on Obstetric Anesthesia, Society for Obstetric Anesthesia and Perinatology. Practice guidelines for obstetric anesthesia: an updated report. Anesthesiology. 2016;124(2):270-300.
2. Callahan EC, Lee W, Aleshi P, George RB. Modern labor epidural analgesia: implications for labor outcomes and maternal-fetal health. Am J Obstet Gynecol. 2023;228(5S):S1260-S9.

3. Flin R, Patey R, Glavin R, Maran N. Anaesthetists' non-technical skills. Br J Anaesth. 2010;105(1):38-44.
4. Gordon M, Darbyshire D, Baker P. Non-technical skills training to enhance patient safety: a systematic review. Med Educ. 2012;46(11):1042-54.
5. Broaddus BM, Chandrasekhar S. Informed consent in obstetric anesthesia. Anesth Analg. 2011;112(4):912-5.
6. Bi M, Zhao Z, Yang J, Wang Y. Comparison of case-based learning and traditional method in teaching postgraduate students of medical oncology. Med Teach. 2019;41(10):1124-8.
7. Thistlethwaite JE, Davies D, Ekeocha S, Kidd JM, MacDougall C, Matthews P, et al. The effectiveness of case-based learning in health professional education. A BEME systematic review: BEME Guide No. 23. Med Teach. 2012;34(6):e421-44.
8. Janssen A, Shaw T, Bradbury L, Moujaber T, Norrelykke AM, Zerillo JA, et al. A mixed methods approach to developing and evaluating oncology trainee education around minimization of adverse events and improved patient quality and safety. BMC Med Educ. 2016;16:91.
9. Dias JJ, Durani P, Singh HP. Enhanced Morbidity and Mortality Meeting and Patient Safety Education for Specialty Trainees. J Patient Saf. 2019;15(1):37-48.
10. Kariya N, Kawasaki Y, Okutani H, Kaneko T, Ueki R, Hirose M. Effects of Simulation Study of High Neuraxial Block During Epidural Analgesia for Labor Pain on Pre/Posttest Evaluation in Junior Clinical Trainees. Anesth Pain Med. 2020;10(1):e100045.
11. Kim TW, Singh S, Miller C, Patel S, Koka R, Schiavi A, et al. Efficacy and Cost Comparison of Case-based Learning to Simulation-based Learning for Teaching Malignant Hyperthermia Concepts to Anesthesiology Residents. J Educ Perioper Med. 2019;21(4):E631.
12. MacLennan K, Minehart RD, Vasco M, Eley VA. Simulation-based training in obstetric anesthesia: an update. Int J Obstet Anesth. 2023;54:103643.
13. Noordman J, Post B, van Dartel AAM, Slits JMA, Olde Hartman TC. Training residents in patient-centred communication and empathy: evaluation from patients, observers and residents. BMC Med Educ. 2019;19(1):128.
14. Kelm Z, Womer J, Walter JK, Feudtner C. Interventions to cultivate physician empathy: a systematic review. BMC Med Educ. 2014;14:219.
15. Cruess RL, Cruess SR, Boudreau JD, Snell L, Steinert Y. Reframing medical education to support professional identity formation. Acad Med. 2014;89(11):1446-51.
16. Xu X, Ruan X, Yu C, Yu X, Quan X, Li X, et al. Differences between resident self-assessments and faculty- assessments on Anesthesiology Milestones and associated factors: a cross-sectional study. BMC Med Educ. 2024;24(1):551.

Figures

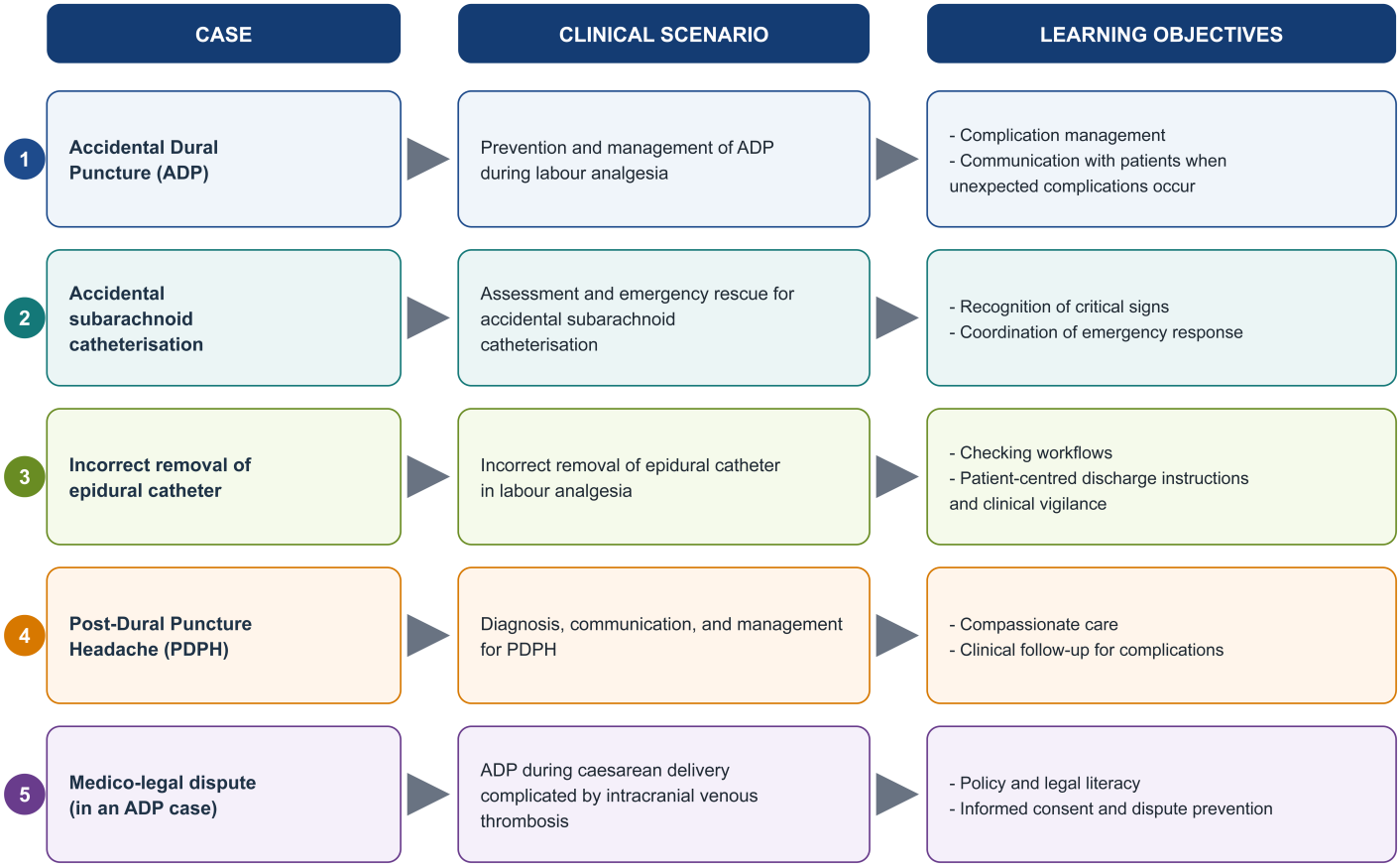


Figure 1

Overview of the case-based learning curriculum for obstetric anaesthesia training. Five anonymised cases derived from patient safety incidents are aligned with their corresponding clinical scenarios and learning objectives; arrows show the alignment across the three columns. ADP, accidental dural puncture; PDPH, post-dural puncture headache.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- BMCMedicalEducationAdditionalfile1Questionnaires.docx
- BMCMedicalEducationAdditionalfile2.docx