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Original Research Article

Effectiveness of Simulation-Based and Structured Clinical Skills Training in General Surgery and Obstetrics & Gynecology for Second-Year MBBS Students in a Government Medical College: A Randomized Controlled Study with 6-Month Follow-Up

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Conflict of interest: Nil

Abstract

Background: India's Competency-Based Medical Education (CBME) framework underscores in early, supervised acquisition of clinical and procedural skills alongside AETCOM competencies. Simulation-based training offers a safe, standardized, and feedback-rich environment for such learning; however, Indian undergraduate programs that holistically integrate simulation-based training across both General Surgery and Obstetrics & Gynecology domains remain deficient.

Objective: To assess the effectiveness and retention of a structured simulation-based skills training program in General Surgery and OBG for second-year MBBS students.

Methods: A randomized controlled trial was conducted among 80 second-year MBBS students, randomized equally into intervention and control groups. The intervention group underwent 4 weeks of structured simulation-based training (2 weeks surgery + 2 weeks OBG) covering 16 essential skills. The control group received traditional teaching. Skills were assessed using Objective Structured Assessment of Technical Skills (OSATS) and Mini-Clinical Evaluation Exercise (Mini-CEX) at baseline, immediately after training, 3 months, and 6 months.

Results: Baseline comparable. Post-training higher scores in intervention (OSATS 85.1 ± 5.4 vs 69.3 ± 6.1; Mini-CEX 8.4 ± 0.8 vs 6.2 ± 1.0; $p<0.001$). At 6 months, retention superior (OSATS 74.0 ± 5.8 vs 59.8 ± 6.5; Mini-CEX 7.2 ± 0.9 vs 5.4 ± 1.0; $p<0.001$). Repeated-measures ANOVA showed significant group×time interaction ($p<0.001$).

Conclusion: Integrated Surgery-OBG simulation training significantly improves and sustains skills in second-year MBBS. Integration into ACMET-aligned CBME with skills labs and workplace-based assessment is recommended.

Keywords: CBME, AETCOM, skills lab, OSATS, Mini-CEX, simulation, Surgery, Obstetrics, India, undergraduate medical education.

Introduction

In several Indian government medical colleges, the long-standing apprenticeship model— "see one, do one, teach one"—has become increasingly difficult to sustain because of heavy clinical workloads, ethical considerations, and limited chances for learners to repeatedly practise under supervision [1]. In specialties such as General Surgery and Obstetrics & Gynaecology (OBG), where technical skill and effective communication are fundamental to safe patient management, these constraints can limit training opportunities. The introduction of Competency-Based Medical Education (CBME) in India aims to ensure that medical graduates demonstrate defined skills, benefit from early clinical exposure, and practise in structured skills laboratories, with the Attitude, Ethics, and Communication (AETCOM) module woven throughout their course [2,3]. For second-year MBBS students (Phase II), progression in skill development is expected to move from the "shows how" stage in simulated settings to the "does" stage in supervised clinical environments, guided by standardized assessment and feedback strategies [4]. Simulation-based training helps to minimise risks to patients, allows for deliberate and repeated practice, and ensures more equitable learning

opportunities when real-case exposure is limited [5,6]. The present study assesses a skills-laboratory–centred simulation training program for General Surgery and OBG, designed in alignment with the NMC Undergraduate Curriculum (2018–2023), the AETCOM framework, and official Skills Lab Guidelines [2,3,7].

Materials & Methods

Design & Setting: Parallel-group RCT (sept2024-jun2025), Departments of Surgery and OBG, Government medical college, Bundi, Rajasthan. Ethics approval and written consent obtained.

Participants: 80 second-year MBBS students randomized (1:1) to intervention vs control. Inclusion: enrolled 2nd MBBS students who gave consent. Exclusion: who doesn't gave consent and are not in 2nd MBBS.

Intervention: (4 weeks; skills-lab)

Surgery (2 weeks): Hand wash, OT scrub, gowning, gloving, knot tying (two-hand/one-hand/instrument), simple interrupted suturing, instrument handling, and basic dressing.

OBG (2 weeks): Obstetric abdominal exam; episiotomy suturing; antenatal/postnatal history+exam; contraceptive counseling (IUCD/condoms/OCPs); breaking bad news (AETCOM).

Structure: Demonstration → Guided practice → Feedback → deliberate repetition →untill Minimum competency reached (cut-scores preset by faculty). Alignment to UG competencies & AETCOM modules [2,3].

Control: Traditional teaching (lectures, opportunistic bedside demos/observation).

Outcomes & Timing: Assessments at baseline, post-training, 3 months, 6 months using: OSATS [8,9] checklists/global ratings (validated structure). Mini-CEX [4,10] (communication/professionalism/clinical reasoning).

Statistical Plan: Between-group comparison using student t-tests (post, 3, 6 months); repeated-measures ANOVA for assessed score changes over time; $p<0.05$ significant.

Results

Baseline Characteristics: No significant differences in age, gender, or baseline scores between groups.

Table 1:

Variable	Intervention (n=40)	Control (n=40)	p-value
Age (years)	20.1 ± 0.9	20.2 ± 0.8	0.72
Gender (M/F)	22/18	23/17	0.84
Baseline OSATS	45.9 ± 6.4	46.1 ± 6.2	0.81
Baseline Mini-CEX	4.1 ± 0.7	4.2 ± 0.8	0.65

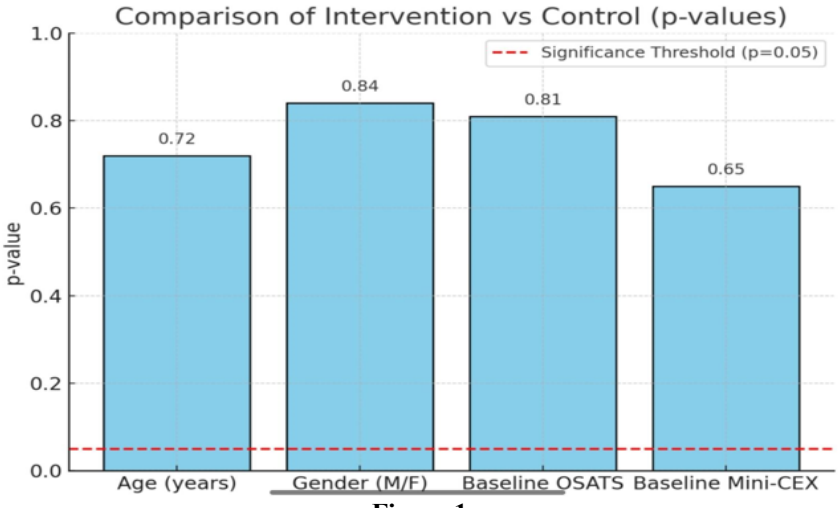

Figure 1:

Skill Performance over Time:

Table 1:

Time Point	OSATS Intervention	OSATS Control	Mini-CEX Intervention	Mini-CEX Control
Baseline	45.9 ± 6.4	46.1 ± 6.2	4.1 ± 0.7	4.2 ± 0.8
Post-training	85.1 ± 5.4	69.3 ± 6.1	8.4 ± 0.8	6.2 ± 1.0
3-month	78.4 ± 5.7	63.1 ± 6.4	7.6 ± 0.9	5.7 ± 1.0
6-month	74.0 ± 5.8	59.8 ± 6.5	7.2 ± 0.9	5.4 ± 1.0

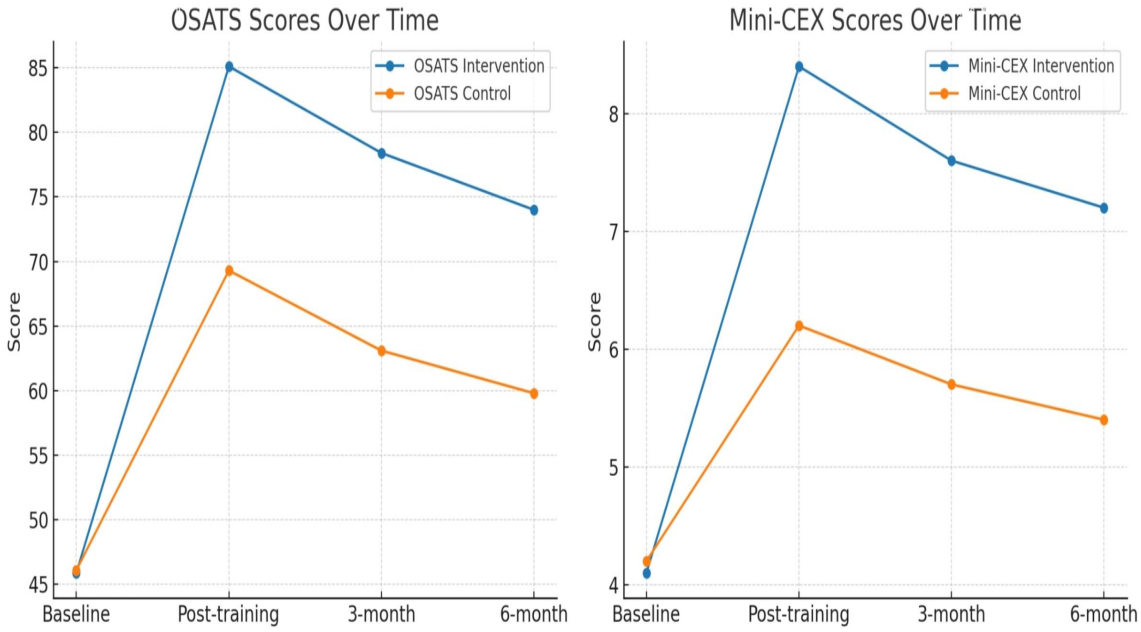

Figure 2:

Repeated-measures ANOVA demonstrated a significant group × time interaction ($p < 0.001$) for both OSATS and Mini-CEX scores.

Discussion

This randomized controlled trial demonstrates that an integrated, simulation-based curriculum in General Surgery and Obstetrics & Gynaecology for second-year MBBS students yields substantial immediate gains in technical and communication competencies, with significant retention at six months. Our findings are consistent with recent evidence that confirms well-structured simulation, incorporating deliberate practice and targeted feedback, enhances both skill acquisition and long-term retention across surgical and obstetric domains [5,6,11,12].

These improvements arise from: (i) safe, repeated practice in skills laboratories without patient risk13,14; (ii) structured, criterion-based feedback that accelerates learning15; and (iii) standardized exposure, ensuring equity of experience and minimizing variability seen in opportunistic bedside teaching [1,16].

Our results are consistent with recent Indian and global RCTs showing positive impacts of simulation training on obstetric emergencies [17], and fundamental surgical skills such as suturing and laparoscopic tasks [9,18]. Using OSATS for technical proficiency and Mini-CEX for professionalism and communication ensured comprehensive assessment, aligned with the CBME and AETCOM competencies mandated by the National Medical Commission [2,3].

Future research should integrate Entrustable Professional Activities (EPAs) to facilitate faculty in structured entrustment decisions and explore higher-level Kirkpatrick outcomes, including behavioural change in clinical settings and patient-level benefits [19,20]. While this single-centre design and simulated endpoints limit direct generalization to patient care, the study's rigorous methodology, competency mapping, and reproducible design provide a scalable model for other Indian medical colleges.

Conclusion

Integrated, ACMET-aligned simulation across General Surgery and OBG significantly enhances immediate performance and medium-term retention for second-year MBBS students compared with traditional teaching. Embedding such programs within NMC CBME (skills labs + AETCOM) and scaling to programmatic assessment (OSATS + Mini-CEX, moving toward EPAs) is recommended for standardized learning, bridge skill gaps, and improve readiness for clinical postings in Indian government colleges.

Limitations:

- Single-center study may limit generalizability
- Short follow-up duration

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