MEDICAL PRACTICE

Training in emergency obstetric skills: is it evidence-based?

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In recent years, training in emergency obstetric skills has moved from the traditional clinical teaching in the labour ward to specific, targeted skills and scenario-based courses utilising mannequins and simulators. Such changes have been necessary, largely as a result of the limitations of traditional clinical teaching when it comes to genuine patient encounters in an emergency situation. The range of simulations now available extends from simple pelvic models to sophisticated computer-based birth simulators. Evidence for the effectiveness of such simulated training is gradually emerging, and in general, transfer of knowledge, improvement of clinical skills and teamwork are all enhanced. However, unequivocal evidence that such teaching improves clinical outcomes is still lacking. Further prospective research on the impact of emergency obstetric training courses as a means of reducing adverse perinatal outcomes is warranted.

Introduction

Modern obstetric practice poses a number of challenges for the training of junior residents that must be addressed if our specialty is to continue to produce competent obstetric specialists (in consultant posts and or in individual practice). There is widespread public concern that it is unacceptable for doctors to practise procedures on patients and many patients demand evidence of competence and a full track record from doctors performing specific procedures. This concern is addressed by our specialty Colleges and other standard setting authorities, and accreditation processes have been formalised for the various specialties, subspecialties, and in particular practice modules. In obstetrics and gynaecology, examples of such modules include laparoscopic surgery, colposcopy or ultrasound for nuchal translucency and other measurements. In terms of emergency obstetrics, "resident" specialist coverage is becoming mandatory in many units. Thus, bearing in mind potential medico-legal issues, junior residents would rarely have the opportunity to practise such skills on patients having dire emergencies.

For the average resident nowadays, more post call night "offs", weekly rest days, and formal compensatory leave for statutory holidays all imply a progressive reduction in working hours. Indeed, the Hospital Authority has formally taken active measures to limit the maximal hours worked to 65 per week.[1] In Europe, the introduction of the European Working Time Directive[2] has similarly reduced the hours of doctors in training, with a consequent reduction in their exposure to patients and relevant clinical repertoires. The Royal College of Surgeons has previously estimated that before the implementation of the Directive, a trainee could expect to work over 30 000 hours before becoming a consultant,[3] but after the implementation of the Directive, this falls to around 8000 hours. Fortunately, such drastic differences have yet to appear locally.

Previous confidential enquiries into maternal deaths in the United Kingdom[4,5] has stressed the importance of emergency drills training, and recommended that these should take place in every maternity unit. When scrutinised, however, fewer than 50% of units actually ran the drills, partly because of difficulty in finding time, space, and personnel on a busy labour ward.[6] A survey of emergency obstetric drills in England and Wales showed that a wide range of training methods were used, but their efficacy remains unclear. The authors advocated more standard national courses instead of local hospital classroom training.[7] A systematic review of training in acute obstetric emergencies in 2003 revealed that few training programmes had been formally established, and even fewer had been evaluated.[8] The confidential enquiries published in 2004[5] acknowledged such deficiencies, and recommended two established drills and scenario-based courses for professionals working on the delivery suite. These were the Advanced Life Support in Obstetrics (ALSO) course, and the Managing Obstetric Emergencies and Trauma (MOET) course, both of which aimed to enhance clinical skills to cope with obstetric emergencies and reduce

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緊急產科技能訓練是否實證醫學？

近年來，緊急產科技能訓練已經從傳統的產房臨床教學，演變至使用人體模型和模擬器教授的針對性場景課程。基於傳統臨床教學實踐的限制，教學模式的轉變是必需的。現時的病人模擬器具多種選擇，包括簡單的骨盆模型以至電腦分娩模擬器。近年來陸續有證據顯示，模擬訓練可強化知識傳遞、改善臨床技能和提升團隊精神。不過，有關模擬訓練能否改善臨床結果的明確證據仍廖廖可數。只有進一步的前瞻性研究才可探討緊急產科技能訓練可否減低不良圍產期結果。

substandard care. The most recent confidential enquires published in 2007[9] recommended that all clinical staff undertake regular, written, documented, and audited training for the early recognition and management of severely ill pregnant women with impending collapse. Such training was to improve basic, immediate, and advanced life support skills. The recommendations extended to establishing 'courses' to provide additional training for staff caring for pregnant women and newborn babies.[9] Faced with the limitations of training junior residents using genuine patients, and the variable results of labour ward 'fire drills' for such purposes, standard courses in obstetric emergency training should become mandatory. Such courses should utilise mannequins, simulations and scenario-based specialist training. Apart from the ALSO and MOET courses, others commonly conducted in the United Kingdom for such purposes include the PRactical Obstetric Multi-Professional Training (PROMPT), and the Multidisciplinary Obstetric Simulated Emergency Scenarios (MOSES). Moreover, various short courses are regularly organised by the Royal College of Obstetricians and Gynaecologists (RCOG) or individual National Health Service Trusts that focus specifically on certain clinical modules, such as postpartum haemorrhage, pre-eclampsia/eclampsia, and maternal resuscitation techniques. In the past 10 years, ALSO courses are regularly run in Hong Kong, under the joint auspices of the Hong Kong College of Obstetricians and Gynaecologists and the Hong Kong College of Emergency Medicine.

Different levels and uses of simulation training

Medical simulations, in general, aim to imitate real patients, anatomic regions, or clinical tasks, and/or to mirror real-life situations or scenarios.[10] Contextually, simulation-based training can be implemented at three levels: tasks, clinical, and environmental levels.[11] Examples of task level skills include wound suturing, laparoscopic tubal ligation or hysteroscopic myomectomy. Specific virtual reality–driven simulators can provide different task-level exercises to take the learner through a sequence of increasingly more complicated skills until he/she can smoothly proceed to the real procedure. Clinical contextual simulations refer to instructions that address the development of procedural and medical reasoning, clinical decision-making, diagnostic judgement, therapeutic interventions, and even resource management. Such simulators utilise sophisticated computer-driven mannequins designed to anatomically and physiologically respond as if it were a human. Examples of expensive computer-based simulators on the market for use in obstetrics and labour ward training include the Birth Simulator (3B Scientific GmbH, Hamburg, Germany) or the Noelle Pregnant Robot (Gaumard Scientific Company Inc, Miami [FL], US). These consist of a maternal mannequin together with a display of a clinical scenario with cardiotocogram tracings, and a fetus that can be delivered by vacuum or forceps. In the Noelle maternal robot, the 'mother' will display vital signs that can progress from shock to cardiac arrest, and the learner is expected to initiate resuscitation and so on. Finally, even more complex virtual reality environments where learners interact with computerised patients (avatars) may provide an acceptable alternative for specific types of learning contexts. Such contexts entail environmental factors that are either logistically not feasible or unsafe to reproduce in reality, as well as certain disaster drills and triaging exercises.[12]

Apart from using simulation for outcome-based training and education, such technologies are now commonly employed for competency assessment. Previously, skills-based training and assessment in clinical medicine depended exclusively on subjective appraisal in the hospital or operating theatre, or was based on the number of surgical procedures logged by the trainee, without any measures of performance. Various specialties have recently introduced a formalised curriculum methodology to quantitatively assess performance of psychomotor skills, entitled Objective Structured Assessment of Technical Skills (OSATS). One of the strengths of simulators for such skills assessment is their high degree of reliability and reproducibility. Use of simulators for such examinations is already occurring in some specialties. Thus, the Royal College of Physicians and Surgeons of Canada utilises computer-based and mannequin simulators for their national internal medicine certification oral examinations.[13] In current obstetrics training in Hong Kong (which follows closely the RCOG), however, OSATS assessments are still designed to be undertaken in real patients rather than simulators. Thus, as of now, simulation is very much underused as a training tool in obstetrics and gynaecology, and has a very limited role in postgraduate training and assessment.

The use of simulation training in emergency obstetrics

In emergency obstetrics training, simulation could be used as an educational tool to assist in the transfer of knowledge, practising diagnostic and simple practical skills, surgical skills, emergency drills, and human factor and teamwork.[14] For the trainee, simulator training can be used for practising common procedures, such as vacuum or forceps deliveries, or dealing with uncommon scenarios having serious consequences (shoulder dystocia, maternal resuscitation). Using a simulator for the first time, they can rehearse their skills and techniques to reach a definite level of competence. This allows the trainee to move up the learning curve more quickly, and perform such skills under supervision more confidently when they encounter their first patient. For the trainer, simulation allows monitoring and comparison of the performance of different trainees, as well as ample time and opportunity to point out errors, demonstrate correct manoeuvres, or emphasise learning points, all of which would be impossible in an emergency situation with genuine patients. Simple simulators can help to demonstrate manoeuvres that are difficult to visualise in vivo. For instance, a simple pelvic model enables clear visualisation of the auto-rotation of the fetal head within the maternal pelvis in a vacuum extraction delivery for persistent occipital-posterior position. Model simulators can also be used to teach clinical examination skills, such as for fetal presentations or mal-positions, and for the clinical assessment of the newborn. Surgical skills training ranges from simple episiotomies and how to repair them or perineal lacerations, to more sophisticated high-fidelity simulators for training in breech deliveries or shoulder dystocia management. In the latter simulations, warning alarms are incorporated to indicate excessive pressure or traction. Emergency drills training may make use of simple mannequins to simulate postpartum haemorrhage with uterine atony, but can also entail expensive computer-based simulators, such as the Birth Simulator or the Noelle Pregnant Robot mentioned above. Such highly sophisticated computer-based models could, for instance, help the novice in assessing the orientation of forceps blades in the maternal pelvis by using on-screen virtual reality 3D reconstruction.[15] Despite the high cost and technology of these high-fidelity simulators, the variations offered by such models in providing different fetal head positions are as yet limited, so that the more experienced operator may not benefit. Thus, further technical advancements appear necessary to improve their cost-effectiveness.

Human error and communication problems are crucial elements to avoid in emergency obstetrics, if disasters are to be prevented. Such factors include teamwork, decision-making, leadership, communication skills, prioritisation and situational awareness.[14] Simulations and scenario-based training can facilitate such training, and enhance individual skills. In a randomised controlled trial in North American maternity units, the effects of teamwork training on the process of care in labour and delivery were evaluated. Intervention in the form of a standardised teamwork training curriculum but without simulation or clinical scenario-based exercises resulted in no improvements in clinical outcome. Apparently, team training alone without clinical drills and patient simulators was ineffective.[16] On the other hand, positive experiences have been reported using high-fidelity simulators to train team coordination in effectively responding to critical scenarios such as postpartum haemorrhage.[17]

The evidence of effectiveness of emergency obstetrics training

Direct effects

One of the immediate effects of emergency obstetric training is to boost the confidence of participants in dealing with such emergencies. In a typical survey,[18] ALSO attendants were given a Likert scale survey measuring comfort with the management of specific obstetrical emergencies and procedures, before, immediately after, 6 months later, and 1 year after participation in the courses. In general, participants reported a significant increase in their comfort with the management of a list of 15 obstetrical emergencies and procedures taught in the ALSO curriculum. Reported comfort levels remained high at the 6-month and 1-year follow-up and this was also accompanied by a statistically significant increase in participants practising various obstetric procedures, such as amnio-infusion, vacuum deliveries, and ultrasound for determining fetal position and placental location. It was concluded that participation in the ALSO course increased knowledge in the targeted domain of learning.[18]

Another potential benefit of emergency obstetrics training is to allow clinicians to learn skills to deal with rare obstetric complications, well before applying these on the very occasional patient in the labour ward. The MOET course has been developed to allow specialist obstetricians to learn/revise procedures on models, and then to have their skills tested in scenario-based assessments. A survey was conducted on 'career' obstetricians in terms of their ability to respond to some of the course scenarios of the MOET and the frequency with which they had undertaken rarer procedures on their patients.[19] Participants were asked to indicate whether they thought a particular management was 'good practice', 'bad practice', or 'good practice but would prefer a caesarean section', and also to indicate the number of such procedures they had undertaken previously. Overall, the respondents concurred with the literature on what would be good or bad obstetric practice. A large proportion of respondents, however, would rather undertake a caesarean section than carry out a 'good practice'. Only around 28% had had some experience dealing with rarer obstetric procedures. The results in this cohort highlighted the lack of practical experience for rarer obstetric procedures, and the potential benefits of skills courses to increase the exposure of specialists to these rarer scenarios.

Outcome evaluations

In a recent systematic review to evaluate the effectiveness of teamwork training in a simulated setting, it was found that very few published reports had specifically and objectively assessed outcome measures. The range of such parameters that could be assessed included clinical outcome (perinatal outcome, such as Apgar scores, or incidence of hypoxic, ischaemic encephalopathy or maternal outcome), knowledge (usually tested by a validated multiple-choice questionnaire score), practical skills (assessed by the participants' ability to complete basic tasks, the use of manoeuvres or successful delivery rates), communications (assessed by a 5-point Likert scale), team performance (acquisition of knowledge, practical skills, behaviour and/or communication), and teamwork theory (when there was additional training on communication, roles, responsibilities, and situational awareness).[20]

The only study published so far that reported on patient outcomes after emergency obstetrics skills training was from a tertiary obstetric referral centre in the United Kingdom, which actually showed an improvement in perinatal outcome.[21] The study measured the effect of the interventions in a total of 19 640 neonates, by comparing the neonatal morbidity in the 2-year pre-training and the 3-year post-training. The frequency of Apgar scores of 6 or lower at 5 minutes decreased from 87 to 45 per 10 000 births (relative risk, 0.5) and the frequency of hypoxic-ischaemic encephalopathy decreased from 27 to 14 per 10 000 births (relative risk, 0.50). The improvement was seen to be sustained over time.[21]

Studies to assess the effect of simulated training on knowledge have yielded inconsistent results. In a recent study by Robertson et al,[22] in the context of a simulation-based obstetric crisis team training programme, no statistically significant improvement in knowledge was found, but there was a positive change in team attitude, and the perception of individual and team performance. Contrarily, a randomised controlled trial assessed change in knowledge using a set of 185 multiple-choice questions and the mean score was noted to increase by 21% ($P<0.001$) with 93% of participants having an increase in their score after training.[23] Another smaller cohort compared lecture-based teaching, simulation-based teaching, or a combination of the two. All groups improved their perceived knowledge, but the combination group showed the most improvement with an increase in post-training score of 14 points compared to only 9 for exclusive simulation- or lecture-based training. However, only the simulation-based group maintained their improvement when retested 3 months later.[24] Overall, evidence pointed to an advantage for simulated training over lecture-based training.

Other studies have looked into the effects of training and improvement in skills. The use of a high-fidelity computer-based mannequins for training in shoulder dystocia management was associated with an increase in the use of basic manoeuvres from 81% to 95% ($P=0.002$) and successful simulated deliveries (defined as delivery of the posterior arm within 5 minutes) increased from 43% to 83% ($P<0.001$). The successful delivery rate after training with a high-fidelity mannequin was 94%, which was significantly higher than that after training with traditional devices (72%; odds ratio=6.5, $P=0.002$). Training with both low- and high-fidelity mannequins improved communication with the patient from 57% to 83%.[25] In addition, specific training in the management of eclampsia was associated with an increase in the completion of basic tasks from 87% to 100%, and the tasks were completed faster (55 seconds compared to 27 seconds, $P=0.012$). The administration of magnesium sulphate was 116 seconds earlier ($P=0.011$) and given more often.[26]

Team performance of residents and midwives during simulated obstetric emergencies—including eclampsia, shoulder dystocia, breech delivery, and postpartum haemorrhage—has been assessed. The most common errors identified involved delay in transport to the operating room, lack of familiarity with medications for obstetric haemorrhage, poor techniques in cardiopulmonary resuscitation, and inadequate documentation in shoulder dystocia.[16] In another study by the same group, it was found that under simulated scenarios for training in the management of postpartum haemorrhage, blood loss estimated by 'gut-feeling' was underestimated by up to 49%, there being less underestimation associated with verbalised guesses from team members and assessment of the simulated patient's haemodynamic status. However, when blood loss estimation was carried out at pre-determined intervals, significant improvements in the estimates were noted and the degree of underestimation was down to 32%. Once again, this study showed that simulations and scenario training could more objectively demonstrate clinical errors, and might also be used to evaluate methods for improving such errors.[27]

However, it must not be assumed that simulators are always superior to humans in enabling effective training. In a comparison between the effects of training involving patient-actors versus simulators, all forms of training were associated with significant increases in scores in all scenarios. When compared with computer-based manikin simulators, however, training with patient-actors was associated with more significant improvements in the perception of safety (P=0.04) and communication (P=0.05) in the course of a postpartum haemorrhage scenario. The authors concluded that training a patient-actor may be more effective in improving perceptions related to safety and communication than training with a computerised simulator,[28] and highlighted the necessity to keep trainees within the context of reality with human patients.

Conclusion

It is evident that standard courses for training in obstetric emergencies will become mandatory in many training programmes for junior residents and midwives, as well as a standard accepted format of continuing medical education and training for established specialists. Simulated training with low-fidelity pelvic models and mannequins or high-fidelity computer-based robots will likely become more and more widespread. While evidence of the effectiveness of such training in reinforcing confidence, transferring knowledge, improving individual skills, and enhancing teamwork and communications among participants is gradually emerging in the world literature, solid evidence that such programmes improve the quality of patient care and clinical outcome is still largely lacking.[29] In addition, the courses that are available locally are limited and thus far there have been no formal studies to assess the impact of these courses on the Hong Kong obstetric scene. Further studies to prospectively evaluate the effectiveness of these emergency obstetric training courses are needed to support their further expansion. In future, new emergency obstetric training programmes should include evaluation and reporting of their impact on clinical outcomes as part of their design.

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