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EDITORIAL

Iconoclasm and evidence implementation. The case for change in obstetric general anaesthesia.

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"Come gather 'round people, wherever you roam,
And admit that the waters around you have grown!"

Bob Dylan: The times they are a-changin'

A 17-year delay between the publication of substantive research findings and large-scale implementation is often quoted [1]. The obstacles in translating the conclusions of applied health research into permanent, 'bedside', clinical change are not unique to anaesthesia. However, it is arguable that the problem bedevils us with a particular severity.

The assiduous avoidance of general anaesthesia has become axiomatic in the safe conduct of obstetric anaesthesia [2, 3]. Nonetheless, there remain circumstances when general anaesthesia, however undesirable, is unavoidable. Despite the conduct of general anaesthesia for caesarean section evolving over more than a century, contemporary clinical practice has been slow to adopt new methods, despite a sound evidence base to support them. In the current issue of *Anaesthesia,* Odor et al. report a UK national, observational cross-sectional cohort, accrued as a pre-specified sub-population and embedded within a larger investigation [4] to determine the prevalence of accidental awareness [5]. The sub-study sought to evaluate the characteristics of anaesthetic technique, in more than 3000 episodes of general anaesthesia, over a 15-month period, in an obstetric population. It casts light upon several areas of practice which are undergoing change. Importantly, many elements of practice demonstrate an identical pattern of glacial progress, supporting an assertion that the rate of change is insufficient.

'Rapid sequence induction' was ubiquitous; however, there was an almost dichotomous split between the use of thiopentone as induction agent, in 53% of cases and propofol in 45.5%. Caesarean section remains a last bastion of thiopentone use in any significant case volume and is divergent with routine clinical practice in almost all other areas of emergency anaesthesia. Several investigators have made the case for the adoption of propofol as a new standard of care in recent years [6]. A recent systematic review found no difference in umbilical cord gases, or other indices of neonatal well-being, between the two drugs [7]. The debate has effectively become moot in several countries, including France and the US, where manufacturing restrictions have rendered thiopentone unavailable. 'Classic' rapid sequence induction eschews the administration of opioids until delivery and cord-clamping to offset a notional risk of neonatal respiratory depression. The practice persisted in the

majority of cases (63.5%). There is high grade evidence that the administration of short acting opioids at induction is devoid of substantial, persistent adverse neonatal side effects and ameliorates unwanted maternal cardiovascular responses to endotracheal intubation [8, 9]. Given the weight of evidence now available to support their utility [10], the adoption of their administration into widespread, routine use is arguably long overdue.

Tracheal intubation is a gold standard in the obstetric population. However, in the event of an isolated airway not being secured, an alternative (most commonly a supraglottic device) is almost always deemed adequate for anaesthesia to be continued, without serious consequence to mother or newborn. This was the case in 9/10 'failed intubations' in this study, a finding convergent with previous reported series [11]. This sets the choice of agent for initial neuromuscular blockade at induction into a context where the offset of paralysis is less relevant than previously emphasised. The use of suxamethonium is still pre-eminent (84.5% cases) since, despite serious drawbacks, it provides excellent tracheal intubating conditions rapidly. These conditions can be emulated, over a similar time profile, by rocuronium (1.2 $mg.kg^{-1}$), with the attendant implications of a longer duration of action. With the advent of sugammadex, to effectively counter the non-depolarising neuromuscular blockade induced by rocuronium, there is a compelling case for it to supplant suxamethonium. Matters of drug cost aside, there is evidence to suggest that this is already taking place in obstetric [12] and other areas of emergency airway management [13]. In reality, the time profile of the offset of paralysis from either drug, in the scenario of an unsecured airway, is clinically unhelpful (by way of several minutes), hence the decision to allow a procedure to continue is often proportionate to the risk incurred.

Peripheral nerve stimulation is a simple, now even venerable, monitoring technology, routinely available in the overwhelming majority of settings where anaesthesia is delivered. However, it was used in only just over half of all cases (52.8%). Active, pharmacological reversal of non-depolarising blockade was not reported for 12% of cases when it was deployed. The prevalence of residual neuromuscular blockade is greater than previously determined and sole reliance on estimated duration of drug activity and clinical impression is inadequate for its detection [14]. These results are at odds with the benefits of peripheral nerve monitoring and existing guidance regarding its use [15]. The very low prevalence of processed EEG monitoring was remarkable (< 5% of all cases). The weight of evidence for its clinical effectiveness is becoming ever more compelling, both in the prevention of inadvertent awareness and other important clinical endpoints [16]. The conclusion has been arrived at after many years of clinical research, including trials of sufficient rigor to overcome imprecision resulting from the very low absolute incidence of explicit awareness [17, 18]. In the absence of identified harms, it is difficult to make a cogent case against the use of this monitoring technology. Crucially, it provides clinicians with reassurance of sufficient depth of anaesthesia at intubation, which end-tidal agent monitoring cannot emulate.

There are several possible explanations why practice has been so slow to change. Firstly, the most robust evidence is inferred from a non-obstetric population. Obstetric anaesthetists may be better persuaded by research in the relevant patient group. Since general anaesthesia is a rare event in obstetrics, generating such context specific evidence is challenging, so conservative practice predominates. Historically, there has been a focus on a

reduction in maternal deaths to their current baseline levels. Mortality as an endpoint is hard for practitioners to ignore when faced with adoption of new ways of working proven to reduce its incidence. The same cannot be said for other outcomes. For some advances, the benefits (e.g. reduced accidental awareness during caesarean section with EEG monitoring) may only be discernible by looking at large populations of patients and thus hard for individuals to appreciate. Without this population perspective, anaesthetists may feel little compulsion to abandon older habits, that have served well throughout a career, without evidence of them inducing significant harm. However, there are hazards of such inertia to both patients and future practitioners. Patient-centred outcomes are now universally recognised as a prevailing research priority. The 5th UK National Audit Project (NAP 5) identified a 'signal' associating the use of thiopentone, as opposed to propofol, with awareness in obstetric cases [19]. The relationship is almost certainly complex, reflecting not so much a direct drug effect, but potential unfamiliarity with its use on the part of trainees required to administer drugs they have rarely or even never used before.

Integrated knowledge translation and the closely allied discipline of implementation science address the problem of how to bridge the 'knowledge-into-practice' gap, when sufficient evidence for change already exists. The application of the principles of implementation science to peri-operative medicine is a relatively new concept [20]. Implementation science frameworks describe how evidence is disseminated, absorbed and translated into practice. A detailed taxonomy of these frameworks is beyond the scope of this editorial, however they are broadly divided into process, evaluative and explanatory [21]. Outcomes focus on acceptability, adoption and feasibility and there is evidence for perioperative interventions demonstrating improvement in multiple domains of research uptake [22]. Traditionally, implementation science has accepted a linear research model, reliant on an accepted pattern of 'bench' science or clinical discovery progressing to efficacy and effectiveness trials thereafter. It is easy to discern the inevitable delays inherent to such a model. Indeed, the study under consideration here reports a dataset that is already nearly three years old and practice may have altered in the interim. These delays can be mitigated to a degree by hybrid studies which evaluate both effectiveness and implementation end-points simultaneously [23].

Enhanced recovery in obstetrics is a good example of implementation science success. In 2011, UK National Health Service (NHS) statistics showed that 7.1% of women who had a caesarean section went home the next day. Growing resource pressures on NHS services and an acceptance of the feasibility of enhanced recovery by the National Institute for Health and Clinical Excellence resulted in research to identify an implementation framework [24] and rapidly synthesise the evidence from multiple studies [25]. By 2018-19, 38.5% of women presenting for elective caesarean section went home on the first day after surgery as a result of widespread implementation of enhanced recovery across the UK [26]. Rapid, wholesale practice change is achievable, despite all the obstacles alluded to.

Taken together, the trends revealed in this paper suggest that UK practice is currently lagging the adoption of change, rather than leading it. After prolonged stasis, there is now a sufficient weight of evidence for obstetric general anaesthesia to evolve in several domains and tools available to orchestrate that evolution effectively.

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