Obstetric anaesthesia update

Dr Lauren Kelly
Specialist Anaesthetist Te Whatu Ora Capital, Coast and Hutt Valley
lauren.kelly@ccdhb.org.nz

Much like in many other areas of anaesthesia, whilst there may not have been any seismic shifts in obstetric anaesthesia, small incremental improvements have continued. This update will cover recent publications whose results can be incorporated into everyday practice, some unintended consequences of treatments as well as issues and challenges to be faced in the future.

Use of tranexamic acid (TXA) in obstetrics - use and unintended consequences

The use of TXA on obstetrics has markedly increased in recent years, and is recommended by the WHO for the treatment of postpartum haemorrhage (PPH). The WOMAN study of 2017[1] was the largest RCT to study the use of TXA in PPH and whilst the authors concluded that TXA is beneficial in reducing the risk of death due to PPH, the study had several limitations and may be of only modest benefit in well resourced settings.

The findings from the TRAAP[2] and TRAAP 2[3] trials do not support the prophylactic use of TXA in the prevention of PPH for vaginal and caesarean deliveries respectively. Despite unconvincing evidence, on the basis of it being cheap with a good safety profile, advice remains to consider giving tranexamic early in post-partum haemorrhage. Early resuscitation, management of coagulopathy and surgical assistance with source control, remain the most important interventions.

One of the unintended consequences of having TXA more readily available in our environment is its potential for drug error. TXA is a potent neurotoxin, antagonising GABA and glycine receptors, leading to profound sympathetic stimulation. Intrathecal administration presents as a failed spinal, rapidly progressing pain and myoclonus starting in the buttocks and legs, followed by sympathetic hyperstimulation, cardiac arrhythmias and seizures. Treatment is supportive, whilst CSF lavage has been used with some effect. The reported fatality rate sits at 50-80% and was recently brought to our attention after case reports were published in South Africa following a cluster of such events[4]. The report incorporated recommendations to reduce the risk of further incidents including:

Education and awareness of all staff in areas where TXA is used
Physical separation of TXA from any dedication spinal/ regional anaesthesia trolleys
Adherence with drug checking procedures
Reporting and reviewing adverse drug events

Neuraxial anaesthesia in parturients with thrombocytopenia

The Society for Obstetric Anaesthesia and Perinatology (SOAP) have published a consensus statement to provide expert guidance on what to do in the case of low platelets in pregnancy[5]. The systematic review distilled the best available evidence and expert opinion to recommend that the risk of spinal epidural haematoma was very low in parturients with a platelet count of >70x 10^9/L when associated with conditions such as gestational thrombocytopenia, ITP and hypertensive disorders of pregnancy. The guidelines do discuss considerations such as aetiology and stability of platelet counts, as well as factors including patient comorbidities, obstetric risk factors, airway examination, risk of general anaesthesia and patient preferences.

Enhanced recovery after caesarean delivery

Many units around the country have adopted ERAS protocols or are in the process of doing so and SOAP have a comprehensive document available that provides evidence-based guidance on various aspects of care[6]. For anaesthetists, most of the recommendations mentioned are probably already being done, such as antacid and antibiotic prophylaxis, regional anaesthesia and multimodal regular post-operative analgesia. Areas that may require review include:

Pre-operative fasting times and carbohydrate loading
Education in the antenatal period, especially with regard to the likely post-op course, analgesia and mobilisation.
Indwelling catheter management

Post operative pain management practicalities
Staffing resources

Epidurals Part 1 - effect on neonatal outcomes
Despite some controversial studies of dubious quality, several studies including that by Kearns[7] has shown that the use of epidural analgesia in labour was not associated with adverse neonatal outcomes.

Epidurals Part 2 - effect on maternal outcomes
A recent study of over 500,000 parturients in New York undergoing their first vaginal delivery and showed that having neuraxial analgesia in labour led to a 14% reduction in severe maternal morbidity, mainly through its reduction in the rate of PPH[8]. Whilst the study was not designed to look at the reasons behind these findings, if we consider the package of care that surrounds epidural analgesia such as IV access and maintenance fluids, regular observations as mandated by protocols and use of IDCs, these are likely to play some role in the findings.

The authors also noted a difference in epidural rates amongst various ethnicities, with people identifying as hispanic, black, asian and other ethnic minorities less likely to receive neuraxial analgesia. In the US, there are marked racial disparities in maternal and perinatal outcomes, with the risk of virtually any poor outcome being 3-5x higher in black populations compared to white populations. Currently huge resources are starting to be poured into task forces at state and federal levels to start addressing these issues.

Perinatal and maternal mortality review committee report findings
The PMMRC recently released its 15th annual report which makes for sobering reading[9]. Whilst in 2020 there were no statistically significant differences detected in perinatal and maternal mortality in the context of the COVID-19 pandemic, there's not much else to celebrate in the findings. Perinatal and maternal morbidity and mortality rates have not changed significantly since the PMMRC began collating data in 2007. Ethnic, deprivation and age inequities persist in all findings, with the burden of poor outcomes falling on Māori, Pacific peoples, Indian populations, those aged under 20 years and those living in areas of high deprivation, all of whom experience worse perinatal outcomes than those of New Zealand European ethnicity.
Wāhine Māori were 2.91 times more likely to die by suicide as a direct result of maternal mortality than women of NZ European ethnicity in the 2006-2020 period.

Epidurals Part 3 - doses, regimes, effect on labour
There's been somewhat of an evolution in the way we use epidurals for labour analgesia, from continuous infusions, manual top-ups through to PCEAs and now PIEBs. There's also been a slow decrease in the concentration of local anaesthesia preparations, all with the goal of providing the best analgesic effect, without causing motor block and impacting on prolonged second stage and risk of instrumental delivery that has long been associated with epidurals.

PIEB with PCEA is superior to straight PCEA with providing good analgesia with less self-administered boluses and lower overall doses required, and less motor block[10].

There's a trend to move away from the conventionally low dose epidural of 0.125% bupivacaine to ultra-low concentrations of less than 0.08% bupivacaine. Many units around the country are changing to 0.0625% bupivacaine or 0.1% ropivacaine for maintenance of epidural analgesia. In a meta-analysis comparing >0.1% bupivacaine to low (0.08-0.1%) and ultra-low (<0.08%) concentrations, ultra-low dose preparations show an increased chance of spontaneous vaginal delivery OR 1.46 (1.18-1.86), reduced motor block OR0.32 (0.18-0.54) and reduced length of second stage -13.2min (-21.54- -4.77) compared to high dose without impact on pain scores[11].

In considering whether epidural analgesia still carries an increased risk of instrumental delivery if ultra-low concentrations are used, the evidence is not yet clear. One recent meta-analysis of 10 studies[12] concluded that when comparing ultra-low dose epidurals to non-epidural analgesia that there was no significant difference in the duration of the second stage of labor (mean difference = 5.71 minutes, 95% confidence interval [CI], −6.14 to 17.83; P = .36) or the instrumental birth rate (risk ratio [RR] = 1.52, 95% CI, 0.97–2.4; P = .07)[12].

Nitrous oxide and its environmental impact

Nitrous oxide is a potent greenhouse gas that absorbs infrared radiation, trapping heat and contributing to climate change. The carbon emissions associated with the use of nitrous oxide are so much worse than other forms of labour analgesia that it's difficult to chart it on the same graph, with 4 hours of nitrous oxide use equating to 245kg CO2e compared to all others being around 1 kg CO2e[13]. There are also significant concerns regarding occupational exposure to high ambient levels of nitrous oxide which has led to several units in the UK ceasing its use.

Nitrous oxide, in its 50:50 O2:N2O mixture of Entonox is used in about 50-60% of labours, with similar rates in Australia and the UK. Entonox use is uncommon in the US, with use in the realm of approximately 5% of all births, whereas the rates of epidural use in the US sit at around 73-80% of all labours. Numerous studies have shown that entonox is more effective for analgesia than intramuscular opioids, about the same as TENS, and less effective than both Remifentanil PCA and Epidural. Despite this, Entonox has only slightly lower overall satisfaction rates than epidurals. When seen from the parturient's perspective, entonox does hold appeal. The time from request to use is usually just a few minutes, it can take the edge off contractions and mobility can be maintained. Additionally, it generally doesn't require any assessment or sign off by a doctor before they can access it, doesn't require iv access, iv fluids, CTG and blood pressure monitoring, nor insertion of an IDC - all things that can change the dynamics of the labour.

Options to address the problem include central and mobile destruction units that can break down nitrous oxide to nitrogen and oxygen. A recently published quality improvement study in Manchester looked at ambient nitrous oxide levels during the last 30 minutes of labour without any scavenging, with scavenging via a mouthpiece and then via a facemask[14]. Their study showed that emissions could be decreased by 71% with the use of the mouthpiece and 81% with the use of a low profile facemask. Whilst these units could be a way forward, they are very expensive and may present a cost barrier to widespread implementation.

Alternatively, if the use of entonox is to be discouraged or stopped, what options are available to fill the void? As seen in countries such as the US where entonox is uncommon in labour, we may need to plan for a significant increase in labour epidural use which would involve a significant upscaling in human resources to meet the number of requests as well as achieve analgesia in a timely manner. The solution to the conundrum of entonox is far from clear and this will be a topic of great debate and study for the near future.

Resources

1. WOMAN Trial Collaborators: Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): an international, randomised, double-blind, placebo-controlled trial. Lancet 2017; 389(10084):2105–2116.
2. Sentilhes L, Winer N, Azria E et al: Tranexamic acid for the prevention of blood loss after vaginal delivery. N Engl J Med 2018; 379:731-742
3. Sentilhes L: TRAAP2: Tranexamic acid for the prevention of blood loss after caesarean delivery. N Engl J Med 2021; 384:1623-1634.
4. Bishop D, Lundgren A, Moran N, Popov I, Moodly J: Intrathecal tranexamic acid during spinal anaesthesia for caesarean delivery: A lethal drug error. SAMJ Nov 2019: 109:(11) 841-844.
5. Bauer M, Arendt K et al: The Society for Obstetric Anesthesia and Perinatology Interdisciplinary Consensus Statement on Neuraxial Procedures in Obstetric Patients with Thrombocytopenia. Anaesthesia Analgesia June 2021 132 (6) 1531-1544
6. Bollag L, Lim G et al: Society for Obstetric Anesthesia and Perinatology: Consensus Statement and Recommendations for Enhanced Recovery After Cesarean. Anaesthesia Analgesia 2021 May 1;132(5):1362-1377.
7. Kearns R, Shaw, M, Gromski S, Lawlor D, Nelson S: Association of Epidural Analgesia in Women in Labor with Neonatal and Childhood outcomes in a Population Cohort. JAMA 2021; 4(10)
8. Guglielminotti J, Landau R, Daw J, Friedman A, Chihuri S, Li G: Use of Labor neuraxial analgesia for vaginal delivery and severe maternal morbidity. JAMA 2022;5(2)
9. Fifteenth annual report of the perinatal and maternal mortality review committee: Reporting Mortality and Morbidity 2020.https://www.hqsc.govt.nz/assets/Our-work/Mortality-review-committee/PMMRC/Publications-resources/15thPMMRC-report-final.pdf
10. Roofthooft B, Schildermans J, Cromheecke S, Devroe S, Nieuws S, Rex S, Wong C, Van de Velde M: Programmed intermittent epidural bolus vs Patient-controlled epidural analgesia for maintenance of labour analgesia: A 2-center, double-blind, Randomized study. Obstetric Anaesthesia Digest Dec 2021 41 (4) 199-203.

11. Halliday L, Kinsella M, Shaw M, Cheyne J, Nelson S, Kearns R: Comparison of ultra-low, low and high concentration local anaesthesia for labour epidural analgesia: a systematic review and network meta-analysis. Anaesthesia 2022, 77, 910-918.
12. Wang, T, Sun S, Huang S: Effects of epidural labour analgesia with low concentration local anaesthetics on obstetric outcomes: A systematic review and meta-analysis of randomised controlled trials. Anaesthesia and Analgesia 2017 124 (5) 1571-1580.
13. Gynther A, Pearson F, McGain F: Nitrous oxide use on the labour ward: Efficacy and environmental impact. Australasian Anaesthesia 2021 183-192.
14. Pinder A , Fang L, Fieldhouse A, Goddard A, Lovett R, Khan-Perez J, Maclennan K, Mason E, MacCarrick T, Shelton C. Implementing nitrous oxide cracking technology in the labour ward to reduce occupational exposure and environmental emissions: a quality improvement study. Anaesthesia 2022, 77, 1228-1236.