Although gastric ultrasonography had been used for almost thirty years by gastroenterologists to evaluate gastric motility and emptying or to diagnose cancer of the gastric wall, it was only approximately ten years ago that the first publications appeared in the anesthesia literature about the perioperative use of bedside ultrasound to evaluate gastric content and volume. This new tool allowed and allows physicians to assess peri-operative patient aspiration risk and guide anaesthetic management. The exam mainly consists of two components. The qualitative component determines if a stomach is empty or contains clear or thick fluid or solid contents. If deemed necessary, the quantitative component of the exam determines how much clear fluid is present and uses for this purpose a validated mathematical tool to estimate total gastric fluid volumes.¹ It is however essential to keep in mind this model has been validated for clear fluids only.

A detailed framework (I-AIM model) was described that presents every conceptual step for the indications (I), acquisition (A), interpretation of gastric ultrasound (I) and the medical decisions (M) concerning anesthetic management to be taken from the obtained information, (https://www.gastricultrasound.org/en/extra-material/faq/#downloads). For the extended technical aspects of the scanning and sonographic presentations of different stomach contents, we refer to two review articles or the abovementioned website.²,³ In brief, the epigastrium of the patient is scanned sagittally with a low-frequency abdominal transducer in the supine and right lateral decubitus position. The aorta and left lobe of the liver serve as anatomical references. This way a cross-sectional view of the antrum of the stomach—which is the most amenable part of the stomach to be scanned—is obtained.

The indications for using gastric PoCUS are the clinical scenarios in which prandial status is uncertain or gastric emptying is possibly delayed.⁴ This can be patients who for whatever reason have not followed the fasting guidelines or have an unclear history (language barrier, cognitive dysfunction, children...) or patients with chronic kidney disease, multiple sclerosis, diabetes....

The question that needs to be answered is -as for most point-of-care techniques- a dichotomous one. Does this patient have a pneumothorax, does that lady have a pericardial tamponade? In this case the question to be answered is: does our patient have an ‘empty’ or a ‘full’ stomach? A definition of ‘full’ is the presence of content that goes beyond what can be found in fasted and healthy patients. This is the presence of clear fluid in excess of baseline gastric secretions being > 1.5 mL/kg clear fluid or the presence of thick particulate or solid content. The volume of gastric contents is an important determinant of regurgitation but the cut-off value of 1.5 mL/kg that confers a ‘full’ stomach and unacceptable aspiration risk is a topic of an ongoing debate and beyond the scope of this short update.⁵

Over the last decade, there has been an ever-rising number of publications on gastric point-of-care ultrasound. The initial focus was on the technique’s development and characterising it in terms of validity, namely is it assessing what it intends to assess and in an accurate way. The reproducibility of the results (reliability) and application in clinical practice (interpretability) were to follow. Gastric PoCUS was investigated in different patient populations: adult, paediatric, morbidly obese, chronic renal failure, diabetes, elective, urgent and emergency surgery. More especially the obstetric population has attracted a huge interest as demonstrated by the large number of publications. Studies have focused on gastric emptying throughout the pregnancy but have focused on term patients and during labour.⁶

Other studies have focused on preoperative drinking policies with different timings and regimens (carbohydrate rich, protein enriched). Testing more liberal drinking policies may help us improve patient comfort, alleviate the effects of starvation, and retain safe gastric volumes. Especially in the paediatric population, the work by Frykholm and Andersson from Sweden has led to modified and more liberal fasting guidelines in children.⁷

Although many aspects that are essential to investigate this new tool have been studied, there are aspects that remain to be evaluated such as the education and implementation into curricula, cost-effectiveness, its role before tracheal extubation because the focus has been in most cases on its preoperative use and other interesting pathways such as its possible application in evaluating enteral feeding in the intensive care environment.

Gastric PoCUS is an exciting new tool that can be added to the armamentarium of the anesthesiologist, but it needs to be seen as an adjunct that increases the safety margin within anesthetic management, together with appropriate medical history and physical exam and it is not meant as a replacement for the fasting guidelines that have an excellent track record.

REFERENCES

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Labor is one of the most intense and painful conditions requiring analgesia. Neuraxial anesthesia is the gold standard to provide effective, safe and reliable pain relief during labor and delivery. Numerous neuraxial techniques exist such as spinal anesthesia, traditional epidural (EPL), combined spinal-epidural (CSE) and dural puncture epidural (DPE). Over time, various refinements have been made to optimize the efficacy of the traditional labor epidural. Modifications include the type of neuraxial technique chosen, local anesthetic (LA) concentration and volume, varying strategies for initiation and maintenance of analgesia with different pump delivery systems and addition of adjuncts to LA (most commonly lipophilic opioids).

The simplest but likely least used technique is spinal anesthesia. This single shot technique is used when rapid onset of analgesia is required, and delivery is expected to occur within an hour (of administration). Although quick and effective, there is no means to supplement analgesia once the spinal effect wears off and in the event that anesthesia is required a repeat single shot spinal, epidural or general anesthesia may be necessary.

Lumbar epidural is the gold standard against which other pain relief measures are evaluated for labor analgesia. The epidural space is identified with the loss of resistance technique and a catheter is inserted into the epidural space. Local anesthetic (with or without adjuvants) is delivered to the epidural space via the catheter. Epidural medication can be administered in various ways: manual boluses by the physician, continuous infusion (CEI), patient controlled epidural anesthesia (PCEA), programmed intermittent epidural boluses (PIEB) or a combination of these. Although safe and reliable, time to onset of analgesia is relatively slow.

In the CSE technique, the dura is intentionally punctured to allow administration of intrathecal medication. The epidural space is located with the loss of resistance technique. Thereafter, a small gauge spinal needle is used to puncture the dura in a needle-through-needle technique. Free flow of cerebrospinal fluid (CSF) confirms correct identification of both the spinal and epidural spaces and accurate midline placement. Intrathecal medication is administered after insertion of the epidural catheter. Maintenance analgesia is provided via the catheter. CSE has a much faster onset time and provides a reliable sacral block due to intrathecal medication when compared to EPL. The rate of unilateral and inadequate blocks is lower and fewer physician top-ups are required. This is possibly due to translocation of epidural medication to the intrathecal space via the dural puncture. Although CSE allows for rapid pain relief, the sudden decrease in maternal catecholamines may result in uterine hypertonus and fetal bradycardia. Other side effects such as maternal hypotension and pruritis may also occur. Due to the intrathecal medication, the epidural catheter cannot be immediately tested to exclude intrathecal, intravascular or malpositioned catheters.

The DPE was first described by Suzuki et al. in a cohort of abdominal surgery patients. As with CSE, the epidural space is located with the loss of resistance technique. The dura is then punctured with a small gauge spinal needle, but no intrathecal medication is administered. It is hypothesized that medication administered in the epidural space will move via the dural puncture into the intrathecal space allowing for faster onset of analgesia, better sacral spread, less unilateral block and lower rate of motor block compared to EPL. As no intrathecal medication is given the unwanted side effects such as uterine hypertonus, fetal bradycardia, maternal hypotension and pruritis are minimized. As the dura is punctured and CSF visualised, confirmation of midline placement is made and a test dose can be administered to rule out an intrathecal or intravascular catheter if desired. Thus, the DPE technique proposed to offer the ‘best of both worlds’ providing most of the benefits of the CSE technique without the unwanted side effects, but a faster and more reliable block when compared to EPL. However, the benefits have not consistently been confirmed in the literature when DPE is compared to EPL or CSE due to heterogenous results.

Three reviews conducted in 2018 and 2019 by Layera et al., Gunaydin et al. and Heesen et al. were unable to provide clear evidence of benefit when DPE was compared to EPL. However, some helpful conclusions could be drawn. DPE offered a more reliable benefit if a 25 gauge (G) spinal needle was used as opposed to the smaller 26G and 27G needles. This was shown by Cappiello et al. and Chau et al. with significantly decreased onset times, improved sacral block, decreased unilateral block and decreased top-ups in the DPE groups. A 27G needle for the dural puncture was used in two trials. Firstly, Thomas et al. found no difference in quality of analgesia evidenced by no difference in catheter manipulation rates, sacral root sparing, unilateral block, peak block level, number of top-up doses and LA consumption. A higher incidence of dry taps also occurred. In contrast, Yadav et al. observed some benefits noting lower visual analogue scale (VAS) scores at 5 and 10 minutes (p<0.008), faster onset time and improved analgesia quality (p<0.05). However, there was no difference in the time to first top up request, LA consumption and duration of labor. Wilson et al. used a 26G needle for dural puncture. They found although time to VAS <10 was shorter in the DPE group, the percentage of patients with adequate labor analgesia at 10 minutes did not differ between groups. No differences in complications or post dural puncture headaches (PDPH) were noted in any studies, however due to small sample sizes, complications occurring less frequently may not have been identified. All trials used varying types, concentrations and volumes of LA which made comparison of results challenging.

Three additional randomized control trials have been conducted since these reviews, but again heterogenous results were found. Two of the trials have incorporated the use of PIEB delivery systems found to be more effective and possibly better suited for use with DPB. The proposed mechanism is that during the administration of a LA bolus, pressure within the epidural space will increase thus facilitating movement of medication into the intrathecal space.

Song et al. compared 3 groups: DPE combined with PIEB, EPL combined with CEI and EPL combined with PIEB including a total of 116 patients. A 25G needle was used for dural puncture. The primary outcome was time to adequate analgesia. As hypothesized, faster onset of analgesia and lower LA consumption was noted in the DPE + PIEB group. Reliable sacral block was also achieved. The incidence of side effects including pruritis, PDPH and maternal hypotension were comparable in all groups. Despite these findings, no difference in maternal satisfaction was found. Unfortunately, due to the lack of a fourth group (EPL and PIEB) in this study, the effect of the PIEB itself is unclear. The extent to which
the DPE alone contributed to the favourable outcomes cannot be isolated from the possible effect of the PIEB. 

Bakhet conducted a study comparing EPL, DPE and CSE combined with a loading dose followed by PCEA in 120 parturients. A 25G needle was used for dural puncture. Primary outcome was mean hourly LA consumption. CSE outperformed both DPE and EPL with regards to LA consumption, time to onset of analgesia, numeric pain rating scale (NPRS) and time to achieve T10 block. There were no significant differences between the DPE and EPL for these observations. Occurrence of motor blockade, side effects and maternal satisfaction were comparable amongst all three groups. Most recently, Tan et al. has reported results from a double-blinded randomized controlled trial comparing DPE to EPL in 132 obese parturients. They suggested that the DPE technique may be useful in this patient population as the dural puncture would confirm mid-line placement resulting in a lower failed epidural rate. Dural puncture was made with a 25G spinal needle and after an initial loading dose, PIEB with a PCEA function provided maintenance analgesia. The primary outcome was a composite of: (1) asymmetrical block, (2) epidural top-ups, (3) catheter adjustments, (4) catheter replacement and (5) failed conversion.

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Abstract SP68 Table 1 Summary of randomized controlled trials reviewed

<table>
<thead>
<tr>
<th>Study</th>
<th>No. of participants</th>
<th>Study group</th>
<th>Control group</th>
<th>LA regime</th>
<th>Primary outcome</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilson et al.5</td>
<td>80</td>
<td>DPE with 26G</td>
<td>EPL with 17G Tuohy needle</td>
<td>Bolus: 12ml 0.125% bupivacaine + 50mcg fentanyl Maintenance: 0.1% bupivacaine with 2mcg/ml fentanyl 10ml/hr, PCEA bolus 5ml 10 min with 32ml/hr limit</td>
<td>Percentage of parturients with adequate analgesia (VAS £10) 10 minutes after block</td>
<td>No difference DPE vs EPL for primary outcome; DPE shorter median time to VAS £10 vs EPL</td>
</tr>
<tr>
<td>Cappiello et al.6</td>
<td>79</td>
<td>DPE with 25G</td>
<td>EPL with 17G Weiss needle</td>
<td>Bolus: 12ml 0.25% bupivacaine Maintenance: 0.125% bupivacaine with 0.2mcg/ml fentanyl 6ml/hr, PCEA 6ml 15 min with no hourly limit</td>
<td>Presence of S1 blockade with VAS &lt;10 within 20 min after block</td>
<td>Higher number of patients in DPE group with primary outcome; DPE had lower rate of unilateral block</td>
</tr>
<tr>
<td>Thomas et al.12</td>
<td>230</td>
<td>DPE with 27G</td>
<td>EPL with 17G Weiss needle</td>
<td>Bolus: 5ml 2% lidocaine as test dose, if negative a further 3ml 2% lidocaine Maintenance: 0.11% bupivacaine with 2mcg/ml fentanyl 10ml/hr, PCEA 5ml 10 min with 30ml/hr limit</td>
<td>Instances of catheter manipulation</td>
<td>No differences in catheter manipulation between groups</td>
</tr>
<tr>
<td>Chau et al.16</td>
<td>120</td>
<td>DPE with 25G</td>
<td>EPL with 17G Weiss needle</td>
<td>Bolus: 20ml 0.125% bupivacaine with 2mcg/ml fentanyl Maintenance: 0.125% bupivacaine with 2.5mcg/ml fentanyl 6ml/hr, PCEA 6ml 15 min with 20ml/hr limit</td>
<td>Time to NPRS ≤1</td>
<td>No difference in time to primary outcome; higher incidence of bilateral S2 blockade at 10, 20 and 30 min; lower incidence of asymmetric block at 30 min, fewer physician top-up boluses</td>
</tr>
<tr>
<td>Yadav et al.17</td>
<td>60</td>
<td>DPE with 27G</td>
<td>EPL with 17G Weiss needle</td>
<td>Bolus: 10ml 0.2% ropivacaine with 2mcg/ml fentanyl Maintenance: 0.2% ropivacaine with 2mcg/ml fentanyl 10ml/hr, repeated in case of inadequate block</td>
<td>No primary outcome stated</td>
<td>Faster onset and better quality analgesia in DPE group</td>
</tr>
<tr>
<td>Song et al.18</td>
<td>116</td>
<td>DPE with 25G</td>
<td>EPL with 17G Tuohy needle</td>
<td>Test dose: 3ml 1.5% lidocaine with epinephrine 15mcg Bolus: 0.1% ropivacaine with 0.3mcg/ml fentanyl Maintenance: 0.1% ropivacaine with 0.3mcg/ml fentanyl CEI groups: 8ml/hr PIEB group: 8ml/hr starting 1 hr after bolus. Both groups PCEA 5ml with 20 min lockout</td>
<td>Time to adequate analgesia VAS ≤30 during 2 consecutive contractions</td>
<td>Time to primary outcome significantly faster in DPE + PIEB group. DPE groups had 52 sensory block more frequently at 30 mins Fewer PCEA and physician top ups and lowest LA consumption in DPE + PIEB group</td>
</tr>
</tbody>
</table>
to regional anesthesia for cesarean section. No significant difference was found for the primary composite outcome between the two groups. However, the authors acknowledge that the confidence intervals were wide and contained potentially clinically relevant differences. There were also no differences in the secondary outcomes including motor block, LA consumption, top-ups, side effects and maternal satisfaction.

One possible explanation for continued conflicting results may be that the mechanisms determining flux through the meninges rely on multiple factors. The size of the dural hole is an important determinant as shown by Bernards et al.\(^2\), where more morphine and lidocaine crossed the dural orifice when the dura was pierced with an 18G versus 24G needle. This would explain why less favourable results were seen in the obese parturient.\(^{2,22}\) A larger sample size would also allow identification of side effects that do not occur commonly such as PDPH.

### REFERENCES


### Table

| Tan et al.\(^{2,22}\) | 132 Obese parturients BMI>35 | DPE with 25G Whitacre needle | EPL with 17G Tuohy needle | Bolus: 15ml 0.1% ropivacaine with 2mg/ml fentanyl Maintenance: PIEB 6ml per 45 min initiated 30 min after bolus, PCEA 8ml lockout 10 min with 45ml/hr limit | Composite primary outcome: 1) asymmetrical block, 2) epidural top-ups, 3) catheter adjustments, 4) catheter replacement, 5) failed conversion to regional anesthesia | No difference between groups for primary outcome | REF\(^{19}\) | CSE with 18G Whitacre needle | Tuohy needle and 25G Whitacre needle EPL with 18G Tuohy needle Bolus: 10ml 0.1% bupivacaine with 2mcg/ml fentanyl Maintenance: 0.1% bupivacaine 8ml/hr, PCEA 5ml with 15 min lockout CSE received 2.5mg bupivacaine intrathecally | Hourly mean consumption of epidural bupivacaine and fentanyl combination | Primary outcome and time to complete analgesia (NPRS<1) significantly lower in CSE group, no difference between DPE and EPL groups | REF\(^{19}\) |

### Abstracts

Bakhet\(^{21}\) et al.\(^{21}\) 120 DPE with 25G Tuohy needle versus CSE with 18G Whitacre needle and 25G Whitacre needle: A systematic review of dural puncture epidural

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Acute pain represents an incredible and difficult challenge in medicine. Most of the physicians are especially concentrated on postoperative pain, forgetting hundreds of other causes responsible for acute pain conditions, both of surgical and medical clinical interest. For an organic and adequate evidence-based management, several guidelines have been published.

Exploring PubMed for ‘acute pain guidelines’, it is possible to find over 2,000 papers just for the last 10 years. The history of guidelines in acute pain starts much before than the last 10 years. It goes back especially to the 90s, with all the interest related to multimodal analgesia and organization of acute pain services. As said before, the huge majority was related to the postoperative pain management. In particular, there were 2 great groups, in Copenhagen (Denmark) and in Athens, Greece that generated an increasing interest on the topic. The first group at the beginning of the 90s started to highlight the concepts on the importance to treat postoperative pain and the possibilities to obtain a good analgesia with the simultaneous use of different analgesics (‘balanced’ or ‘multimodal’ analgesia). The other one, in the same period of time, was more addressed to demonstrate how important (crucial) was the organization based on nurses, to obtain a rewarding management of postoperative pain.

After that, hundreds of evidence-based guidelines and recommendations have been published. We will analyze the most relevant. Also, we will focus the attention on the real influence of all those publications and guidelines on the on-bed assistance, and on the change of epidemiological data related to acute pain. At the end, we will propose some new vision that should be implemented, thank to technological developments, if we really want to have an impact on the incidence of acute pain and pain chronication.