

# Update on the Obstetric Anesthesia Practice in Flanders/Belgium: A 10-year follow-up survey and review

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## Abstract

**Background:** With 75% of women receiving neuraxial anesthesia for labor and cesarean section (CS) in Flanders, Belgium, obstetric anesthesia is an essential part of perinatal care. Despite advancements in obstetric anesthesia and guidelines being updated regularly, past surveys have shown great variability among hospitals.

**Objective:** This investigation aims to observe current obstetric anesthesia practices, compare them with previous surveys, and assess adherence to guidelines among anesthesiologists.

**Methods:** An online questionnaire-based survey, approved by the KU Leuven Ethics Committee, was conducted focusing on three main topics: analgesia during labor, anesthesia for CS, and postoperative analgesia after CS. The survey, consisting of 127 questions, was distributed via email to the heads of anesthesia departments in 57 Flemish hospitals providing obstetric anesthesia care. Responses were anonymously analyzed.

**Results:** For labor analgesia initiation, a conventional epidural with administration of ropivacaine 0.2% (+-sufentanil) remains the most widespread used technique, although Combined-Spinal Epidural (CSE) has gained significant popularity. Patient-controlled epidural analgesia (PCEA) in combination with continuous epidural infusion (CEI) is the preferred maintenance method, however programmed-intermittent bolus (PIEB) has found its way into standard practice.

CSs are mostly done by performing CSE or single shot spinal, using hyperbaric bupivacaine 0.5% with sufentanil. Spinal-induced hypotension is treated with a combination of left lateral tilt, fluid administration and vasopressor administration, usually as a bolus. Post-CS pain is mainly treated by a combination of oral/parenteral analgesics and neuraxial analgesia (PCEA +- CEI), with only a minority choosing regional techniques such as wound infiltration, transverse abdominal plane blocks, quadratus lumborum blocks, etc.

**Conclusion:** Compared to previous surveys, the Flemish anesthesiologists adhere well to the latest guidelines and gold standards in obstetric anesthesia, consistently modernizing their practices. Nevertheless, with the continual introduction of novel techniques and methods, it is imperative for practitioners to maintain efforts in pursuing ongoing innovation.

**Keywords:** Obstetric anesthesia, neuraxial anesthesia, analgesia for labor, cesarean section, postoperative analgesia.

## Introduction

Anesthesia is a crucial aspect of perinatal care worldwide. Obstetric anesthesia practices may vary from area to area. Several surveys on the obstetric anesthesia practices in Flanders and Belgium have been published in the past<sup>1-3</sup>.

According to the Flemish 'Study Centre for Perinatal Epidemiology' (SPE), in the period between 2013 and 2022 there has been a decline in

the annual delivery rate in Flanders. In 2022, 61.872 women gave birth of which 22% were delivered by cesarean section (CS) and 78% delivered vaginally. In total, almost 75% of women received neuraxial anesthesia<sup>4</sup>. Furthermore, anesthesia support is always required for CS.

In recent years, the field of obstetric anesthesia has seen remarkable advancements, revolutionizing the way we approach pain management and maternal care during labor and delivery. These innovations

have not only improved the experience of childbirth for mothers but also enhanced safety for both mother and baby. However, as previous surveys have shown, obstetric anesthesia practice is very variable between hospitals and practitioners<sup>1,2</sup>.

The goal of the present investigation is to perform a survey of peripartal, obstetric anesthesia practice and compare it with the previous surveys and describe the evolutions observed. Additionally, we want to evaluate the uptake of obstetric anesthesia guidelines and recommendations by the anesthesia community.

## Methods

We performed a questionnaire-based survey which was approved by the KU Leuven Ethics Committee on October 12, 2022 (Prof. dr. Pascal Borry, chairperson of the Education-Support Committee for Medical Ethics KU Leuven and prof. dr. Minne Casteels, chairperson of the UZ/KU Leuven Research Ethics Committee). We constructed a questionnaire, consisting of 127 individual questions, using Qualtrics XM Enquête Software, provided by KU Leuven. We focused on 3 topics comparable to the previous questionnaire from 2014<sup>2</sup>:

1. Analgesia during labor
2. Anesthesia for CS
3. Postoperative analgesia after CS

The investigated aspects are summarized in Table I.

The survey was sent on January 26, 2023, by email to the head of department of anesthesia of the 57 Flemish hospitals that provide obstetric anesthesia care. Respondents were asked to fill in the name of the

hospital, so we could track the responses. However, all data were anonymously analyzed. An informed consent form was presented at the beginning of the questionnaire and respondents could only proceed if they consented to participation. A reminder mail was sent 3 times, each with a 4-week interval, to the hospitals that didn't complete the survey yet. The remaining departments were contacted by phone. We closed the survey 3 weeks after this phone call on June 18, 2023. Non completion for all questions was not an exclusion criterion. The results were analyzed within Qualtrics Software that presented the descriptive data in percentages and graphs. Next, these results were compared with the results of the previous questionnaires from 2004 ('Van Houwe et al') and 2014 ('Versyck et al') as well as latest guidelines regarding obstetric anesthesia.

## Results

The response rate was 52 out of 57 hospitals (91.2%). The number of responses is displayed for each question. Due to pharmaco-economic rationalization of the health care by the government, the number of maternity units has decreased since the 2004 and 2014 surveys, resulting in fewer responses. Furthermore, a 'skip and display'-logic was incorporated in our survey, leading to fewer responses for some questions as well (as these may only have been displayed to a fraction of respondents).

### *Analgesia for Labor*

#### *1) Nil Per Os (NPO) policy (51responses)*

All hospitals had a NPO policy implemented and

**Table I.** — Topics that are evaluated using the questionnaire.

Topic	Investigated, analyzed, and discussed aspects
Analgesia for labor	<ul style="list-style-type: none"> <li>• Nil per os (NPO) policy</li> <li>• Fluid management</li> <li>• Neuraxial technique</li> <li>• Patient positioning</li> <li>• Loss-of resistance technique</li> <li>• Epidural catheter depth</li> <li>• Test dose policy</li> <li>• Anesthetic mixture</li> <li>• Maintenance method</li> <li>• Non-neuraxial analgesia</li> </ul>
Anesthesia for CS	<ul style="list-style-type: none"> <li>• Neuraxial technique</li> <li>• General anesthesia</li> <li>• Aspiration prophylaxis</li> <li>• Antibiotic prophylaxis</li> <li>• Uterotonics</li> <li>• Hypotension management</li> </ul>
Postoperative analgesia after CS	<ul style="list-style-type: none"> <li>• Oral/parenteral analgesics</li> <li>• Neuraxial analgesia</li> <li>• Regional techniques</li> </ul>

allowed food or clear liquids throughout labor while in 2014 still 5 hospitals had an NPO policy which allowed no oral intake during the entire duration of labor. The majority (65%; 34) allow food until active labor is started and from then only allow clear liquids. In 11 labor and delivery units, only clear liquids are allowed. Solids are allowed in 6 hospitals throughout labor.

#### 2) Fluid management (52 responses)

A vast majority (81%; 42) reported administration of a prophylactic intravenous (IV) fluid bolus before placement of neuraxial analgesia, with 20 hospitals (38%) having this practice standardized, 12 hospitals (23%) doing it 'regularly' and 10 hospitals (19%) doing it 'sometimes'. A minority (19%; 10) does not administer a fluid bolus. Fluid pre-loading consists in 13 hospitals (25%) of 250ml, in 26 hospitals (50%) 500ml, and in 3 hospitals (6%) 1000ml.

#### 3) Technique to initiate neuraxial analgesia (52 responses)

Neuraxial analgesia is initiated using conventional epidural analgesia in 52% (27 hospitals). Combined-Spinal Epidural (CSE) is used in 25 hospitals (48%) of which CSE is used as the standard initiation technique in 19 hospitals (36%) and on indication in 6 hospitals (12%). Figure 1 compares the use of CSE in 2004, 2014 and 2023. CSE is more and more popular and is used in almost half of institutions. In the 6 hospitals which used CSE on indication, the most common indications for performing a CSE were advanced labor (defined as >7cm of cervical dilation), high perceived pain by women and a history of failed epidural(s) or personal choice of the anesthesiologist.

#### 4) Test dose (52 responses)

The use of a local anesthetic (LA) test dose to confirm correct placement of the epidural catheter for labor analgesia continues to decrease. While this practice was performed by 67% in 2004 and 56% in 2014, only 46% (24 hospitals) today use a test dose after placement of an epidural catheter. The epidural mixture used for labor analgesia is used most frequently as test dose (10 hospitals; 19%), followed by lidocaine 2% with adrenaline (6 hospitals; 12%), lidocaine 1% with adrenaline (5 hospitals; 10%), lidocaine 2% without adrenaline (3 hospitals; 6%) and lidocaine 1% without adrenaline (1 hospital; 2%)

#### 5) LA mixture for initiation

a) Conventional epidural (33 responses, multiple answers possible)

In figure 2, LAs used for epidural loading are compared for 2004, 2014 and 2023. Ropivacaine remains the preferred LA for initiation of labor

analgesia using the epidural catheter, with 28 hospitals (85%) using it as their first-choice LA. The vast majority (64%; 18) uses a concentration of 0.2% of ropivacaine, although a smaller subgroup (18%; 5) report using 0.125%. No hospitals declared using concentrations higher than 0.2%. Levobupivacaine is being used by 4 centers (12%) with a usual concentration of 0.125% and only 1 hospital using a 0.25% concentration. Only 1 center (3%) disclosed lidocaine 2% as their first-choice LA. Bupivacaine is no longer used. Sufentanil is added by 94% of hospitals (33) to the LA mixture, usually in a concentration of 0.5 - 0.75 mcg/ml, a further increase from 2004 and 2014. Hence in two hospitals no additives were given. The volume of the administered loading dose varied significantly between hospitals, with a majority of 18 hospitals (55%) administering between 10 and 12 ml. Eight hospitals (24%) administer less than 10ml, 3 hospitals (9%) administer between 12 and 14 ml and 4 hospitals (12%) administer between 14 and 16 ml.

b) CSE (25 responses, multiple answers possible)  
In figure 3 the LAs for CSE loading are compared for 2004, 2014 and 2023.

Ropivacaine is also preferred to initiate analgesia with the spinal component (17 hospitals, 68%) of a CSE. The most reported concentration used for ropivacaine is 0.2% (65%; 11), followed by 0.125% (24%; 4) and 0.16% (11%; 2). Levobupivacaine is used by 32% (8) with the majority using a concentration of 0.125% (63%; 5), followed by 0.25% (25%; 2) and 0.5% (12%; 1). Sufentanil is added in 68% to the LA mixture, with a concentration between 0.5 and 0.75mcg/ml. The use of bupivacaine and other additives than sufentanil was not reported. The injected spinal volume ranges between 1 and 4 ml, with 11 hospitals (44%) injecting between 1 and 2 ml, another 11 hospitals (44%) injecting between 2 and 3 ml and 3 hospitals (12%) injecting between 3 to 4 ml.

#### 6) LA mixture for maintenance (50 responses, multiple answers possible)

Figure 4 summarizes the preferred LAs for maintenance of epidural analgesia in 2004, 2014 and 2023.

With 76% hospitals (38), ropivacaine is also the first choice of LA for maintenance of analgesia during labor. Again, 0.2% was the most frequently used concentration for ropivacaine (54%; 21), followed by 0.125% (23%; 9) and 0.15% (21%; 8) (1 missing data). Levobupivacaine for maintenance is used by 12 hospitals (23%), with a majority wielding a concentration of 0.125% (75%; 9), 1

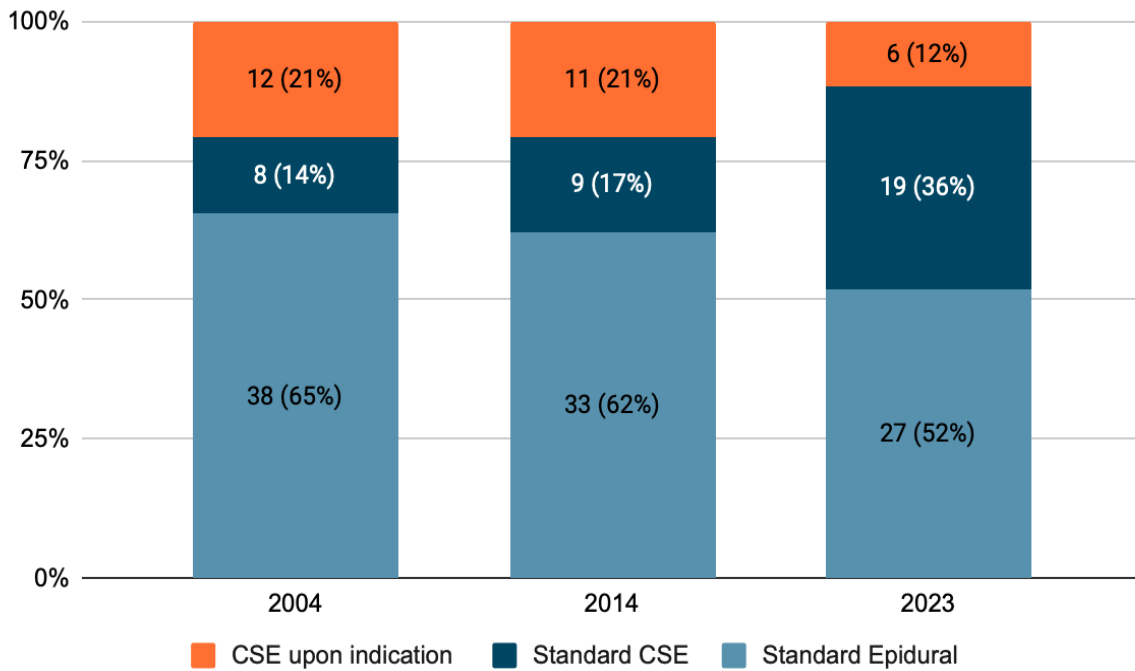


Fig. 1 — Neuraxial Technique for Labour.

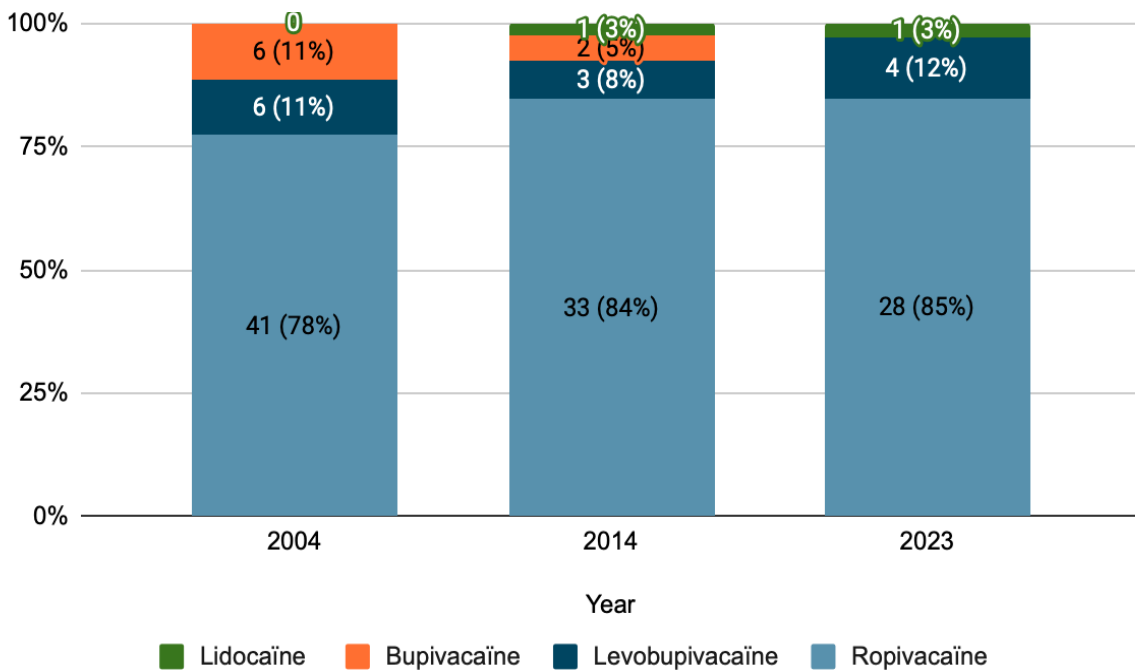


Fig. 2 — Local anaesthetic for epidural loading.

hospital using 0.25% and another hospital using 0.5%. In line with the findings for epidural and spinal loading, bupivacaine is no longer in practice for maintenance of analgesia. Sufentanil is added by 92% to the LA maintenance mixture, again with a usual concentration of 0.5 to 0.75 microgram/ml. Only 1 hospital reported adding clonidine.

7) Maintenance method (58 responses, multiple answers possible)

Figure 5 compares the methods employed for maintaining analgesia during labor in 2004, 2014 and 2023. With 60% (35 hospitals), Patient-

controlled epidural analgesia (PCEA) combined with a background Continuous epidural infusion (CEI) remains the most frequently used method to maintain analgesia during labor. The volume of the administered PCEA-bolus varies from 2 to 9 ml, with the majority (62%; 21) having a bolus of 3 to 5 ml. Lockout times between each PCEA-bolus are between 16 and 20 mins for 49% of hospitals (17). The usual infusion rate of CEI is either 2.1 to 4 ml/h (11) or 4.1 to 6ml/h (11). Five hospitals reported an infusion rate of less or equal than 2ml/h.

The use of Programmed-intermittent epidural bolus (PIEB) has become popular in the last

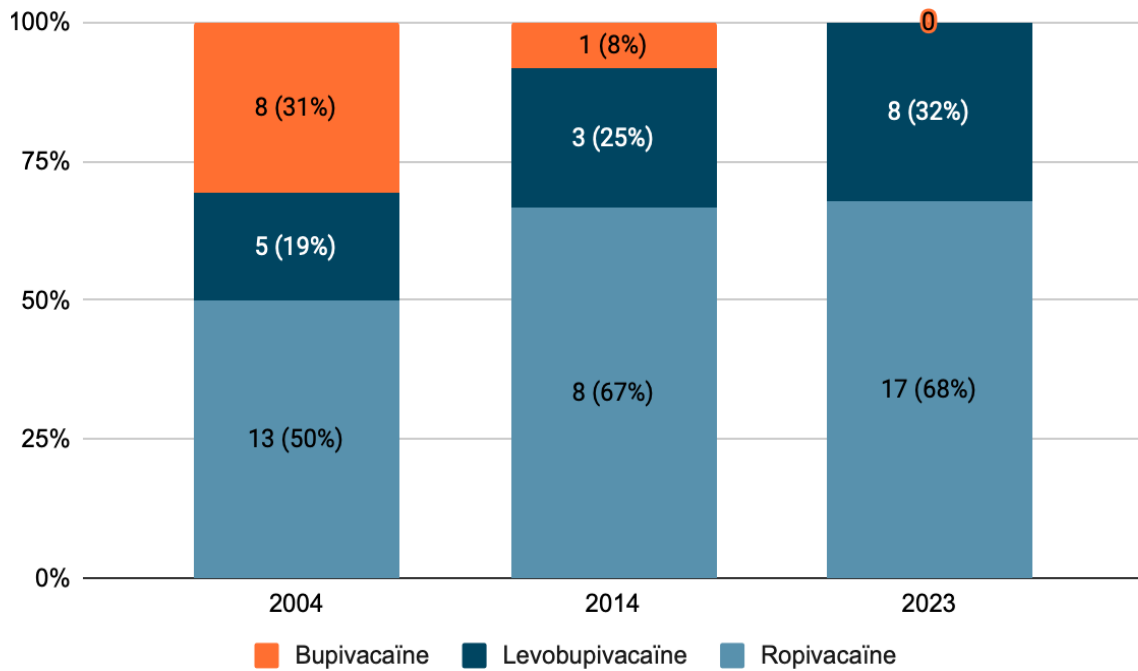


Fig. 3 — Local anaesthetic for CSE loading.

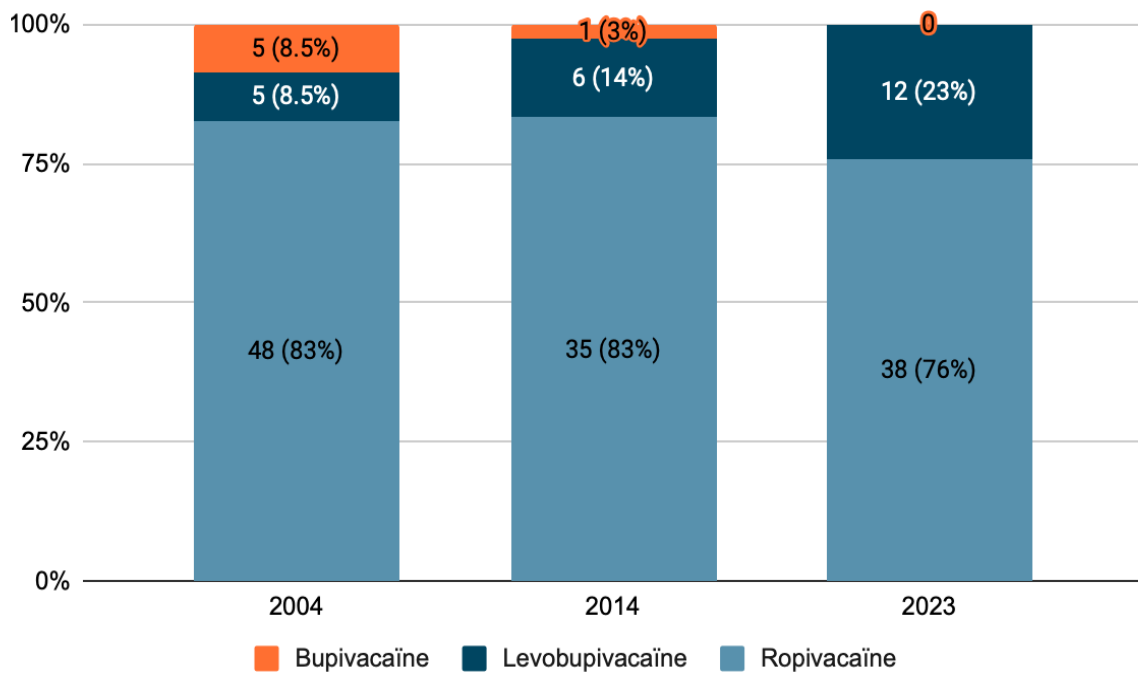


Fig. 4 — Local anaesthetic for maintenance.

decade. Compared to 2014, when only 1 hospital reported the application of PIEB, 12 hospitals (24%) have now incorporated this regime in their practice. The most reported conventional volume for the programmed bolus is 9.1 to 11 ml (8 hospitals) and 41 to 60 minutes is the most recurring bolus interval (7 hospitals). Extra PCEA-boli in between are allowed by 75% of hospitals (9), with a usual volume of 3.1 to 5 ml (8), a lockout time of 16 to 20 minutes between every PCEA-bolus (6) and lockout time of 11 to 20 minutes between a PIEB- and a PCEA-bolus (8).

The use of CEI without bolus function has further declined over the last years with only 6 hospitals (12%) still using this method today, compared to 9 hospitals in 2014 and 30% in 2004. The most reported rate was 7.1 to 9 ml/h (4).

Surprisingly, manual top-ups by midwives or anesthesiologists are still performed in 5 hospitals (10%), whereas in 2014, this was only reported by 3 hospitals. The usual volume for a top-up is either less than 5ml (40%; 2) or between 5.1 and 7ml (40%, 2). Only 1 hospital administers top-ups of more than 10ml.



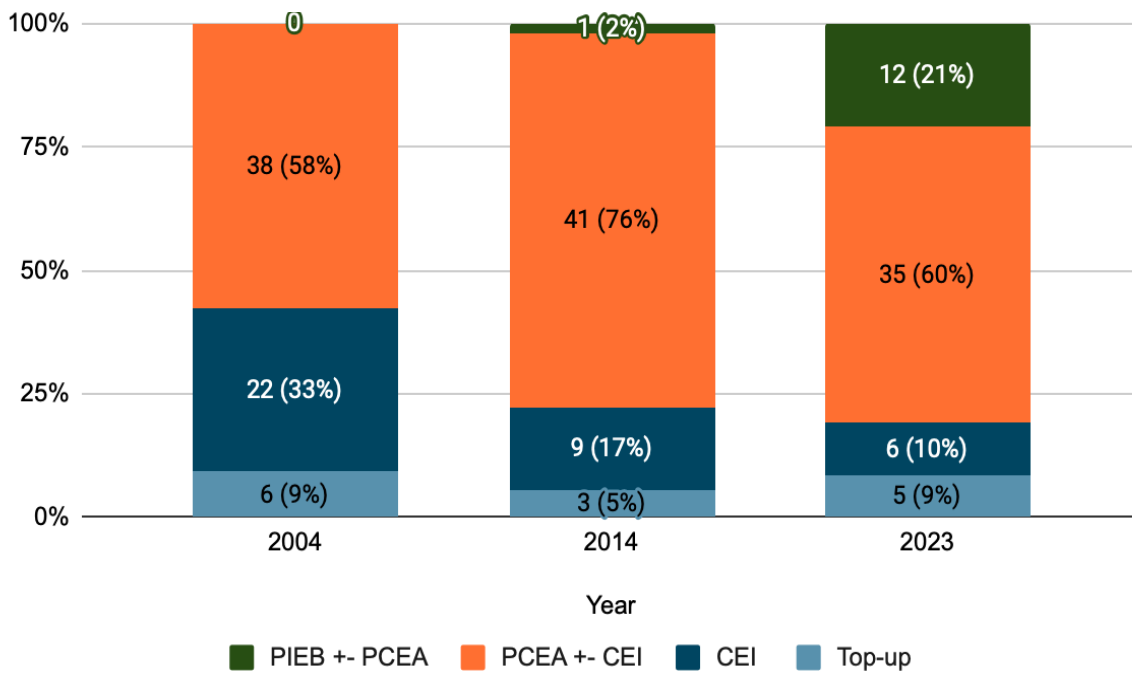


Fig. 5 — Maintenance Method.

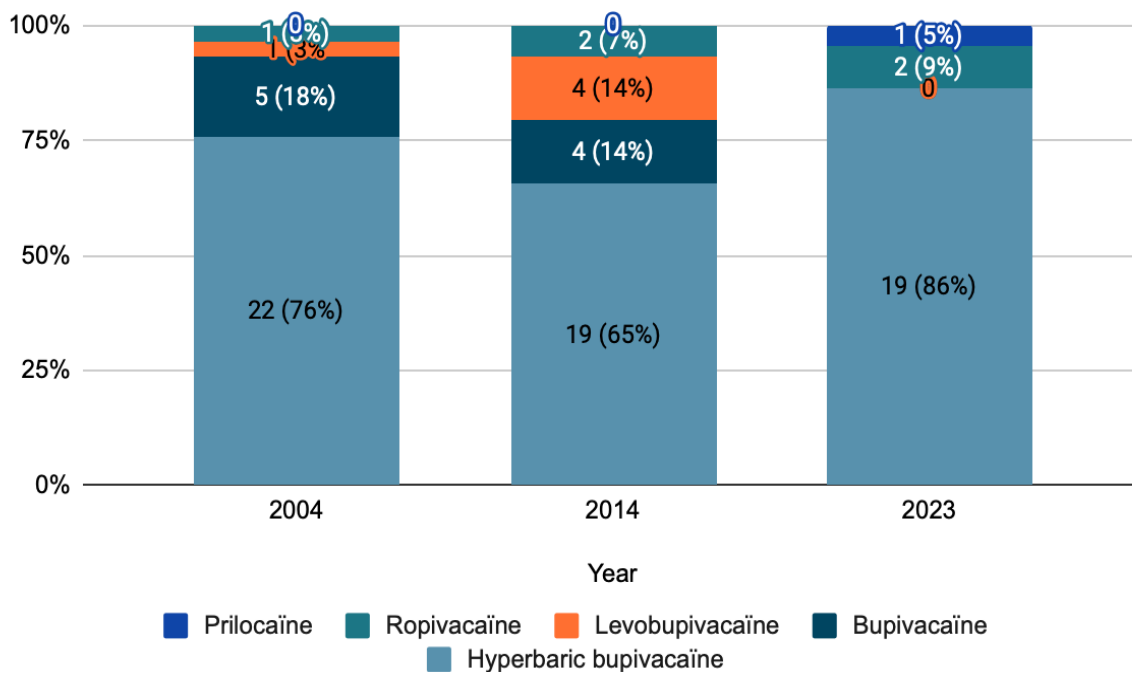


Fig. 6 — Local anaesthetic in SSS for CS.

#### 8) Non-neuraxial analgesia (52 responses)

Non-neuraxial analgesia is offered by 29% (15) of hospitals to women during labor. However, all these hospitals declare that non-neuraxial analgesia is applied for less than 1% of all parturients. Most frequently reported indications for non-neuraxial analgesia are patients with a clotting deficiency, a history of multiple failed epidurals, a defined or high suspicion of (severe) allergy to LAs and choice of the patient. IV tramadol, either administered intermittently or as a continuous infusion, is the most frequently noted alternative for neuraxial analgesia (67%, 10). Remifentanyl as a continuous IV infusion

is offered by 3 hospitals and 1 hospital offers IV remifentanyl as patient-controlled analgesia. Combined, this is an increase of 50% compared to 2014 when only two hospitals reported remifentanyl usage. However, all hospitals declared to take safety measures when administering remifentanyl to women, such as application of nasal oxygen, continuous capnometry, a separate IV line for remifentanyl infusion, a safety valve on the IV line and one-on-one follow-up by the assigned midwife. Only 1 center declared nitrous oxide inhalation as a form of non-neuraxial analgesia without any specific safety measures.

## Anesthesia for CS

### 1) Neuraxial Anesthesia Technique (50 responses)

The preferred neuraxial technique for performing a CS, depends on 2 main factors: planned CS versus unplanned and, in case of the latter, whether the parturient already has an epidural catheter in place. For planned CS, 62% (31) select a CSE as their primary anesthesia technique, and 36% (18) opt for a single shot spinal (SSS). One hospital (2%) uses both techniques. For an unplanned CS without receiving preceding neuraxial analgesia, the distribution is 54% (27) versus 42% (21) for CSE and SSS respectively, with 2 centers (4%) choosing either CSE, SSS or general anesthesia (GA) depending on the urgency of the CS. When an epidural catheter is already in place, anesthesia for secondary CS is almost exclusively (96%; 48) provided by topping up the in-situ epidural. Only 2 hospitals (4%) then prefer to perform a new SSS. No hospitals reported performing a de novo epidural, either for planned or unplanned CS.

#### a) SSS (22 responses, multiple answers possible)

Figure 6 compares the used LAs in 2004, 2014 and 2023 for providing anesthesia during CS when a SSS is employed. Hyperbaric bupivacaine 0.5% is still convincingly preferred (86%; 19). The vast majority (84%; 16) adds 2.5 to 5mcg of sufentanil to the mixture. Morphine as an add-on was reported by 1 hospital. The administered volume is either 1.5 to 2.0ml or 2.1 to 2.5ml, with only 2 hospitals reporting to inject more than 2.5ml of a hyperbaric bupivacaine mixture. Two hospitals noted using 2 ml of ropivacaine 1% with sufentanil when performing SSS. Only 1 hospital reported using 2.5ml of prilocaine 1% with 2.5mcg of sufentanil.

#### b) CSE (31 responses, multiple answers possible)

Figure 7 compares the used LAs in 2004, 2014 and 2023 for providing anesthesia during CS when a CSE is employed. As for SSS, hyperbaric bupivacaine 0.5% is almost exclusively used, with only 2 out of 31 hospitals (6%) choosing levobupivacaine and no other LAs reported. 86% (25) add sufentanil to the mixture, either 2.5mcg (86%) or 5mcg (14%) and the injected volume, 1.5 to 2 ml and 2.1 to 2.5 ml are equally reported (48%; 13). Only 1 hospital administers more than 2.5 ml of hyperbaric bupivacaine mixture. The 2 hospitals using levobupivacaine noted a concentration of 0.5%, both with sufentanil added. One hospital injects 1.5 to 2 ml and the other one 3 to 4 ml.

#### c) Top-up of epidural (54 responses, multiple answers possible)

Figure 8 compares the used LAs in 2014 and 2023 (no data was available from 2004) for providing anesthesia during CS when an epidural top-up is

employed. Ropivacaine is used by 52% (28) of the responders, usually with a concentration of 0.75% (90%, 25). More than half (57%; 16) add sufentanil to the ropivacaine mixture and 50% (14) administer a volume of 10 to 15 ml. Lidocaine is given in 12 hospitals, accounting for 22% of the responses. Usually as a 2% concentration (only 1 hospital uses a 1% concentration). Only 25% (3) add sufentanil to the lidocaine-mixture, however adrenaline was added by half of them (6). The injected volume of a lidocaine mixture was also 10 to 15 ml (45%; 5). Four hospitals (7%) reported using 2-chloroprocaine 3%, 1 hospital (2%) uses plain bupivacaine 0.5% and another hospital (2%) uses levobupivacaine 0.5%. Interestingly, 7 hospitals (13%) prepare a mixture of ropivacaine + lidocaine, with varying concentrations (either 1% or 2% lidocaine and 0.375% to 1% ropivacaine) and 5 of them (71%) also add sufentanil to this mixture. The administered volume depended mostly on the used concentration. One hospital reported using a mixture of lidocaine 1% + levobupivacaine 0.5% without sufentanil and administers a volume of 20ml. Only 23% (11) give a test dose before topping-up an in-situ epidural and most (73%) use the same LA mixture as a test dose. Other mixtures mentioned as a test dose were lidocaine 1% with adrenaline (1) and lidocaine 2% with adrenaline (1) and lidocaine 2% without adrenaline (1).

### 2) GA (50 responses)

No hospitals reported GA as their primary anesthetic technique for CS, unless neuraxial anesthesia is contraindicated and/or for emergent CS.

In the event GA is necessary, all responders report propofol as their first hypnotic agent of choice for induction of GA. About 50% use a second hypnotic agent in combination with propofol, mainly (es)ketamine (84%), but also midazolam (12%) is reported. Thiopental has been completely abandoned, while still 2 hospitals used this hypnotic in 2014 and 33% in 2004. For maintenance of GA 60% (30) always use sevoflurane, 10% (5) always chooses total intravenous anesthesia (TIVA) with propofol and 30% (15) chooses either sevoflurane or TIVA with propofol, depending on the situation. As for muscle relaxants, rocuronium is preferred by 82% (41), followed by succinylcholine (14%), compared to 38% and 45% respectively in 2014. No other muscle relaxants are used. Two hospitals do not use muscle relaxants. 26% (13) give opioids already at induction of GA, while 76% do give opioids only during maintenance of GA, after cord clamping. For induction, the preferred opioid is remifentanyl (77%), while for maintenance

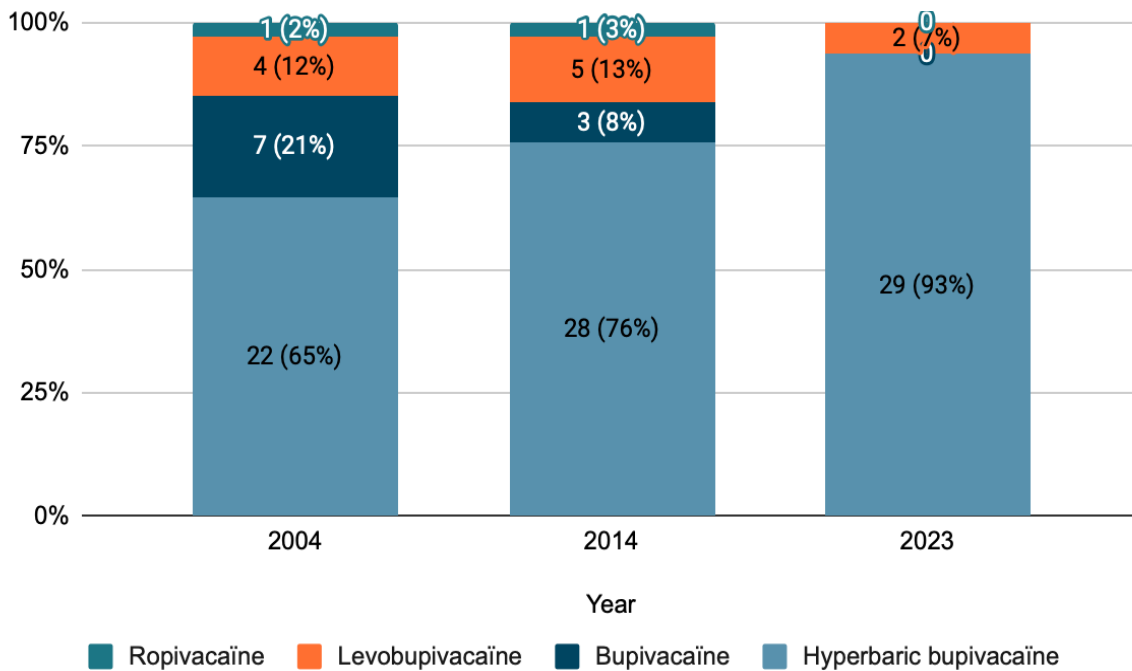


Fig. 7 — Local anaesthetic in CSE for CS.

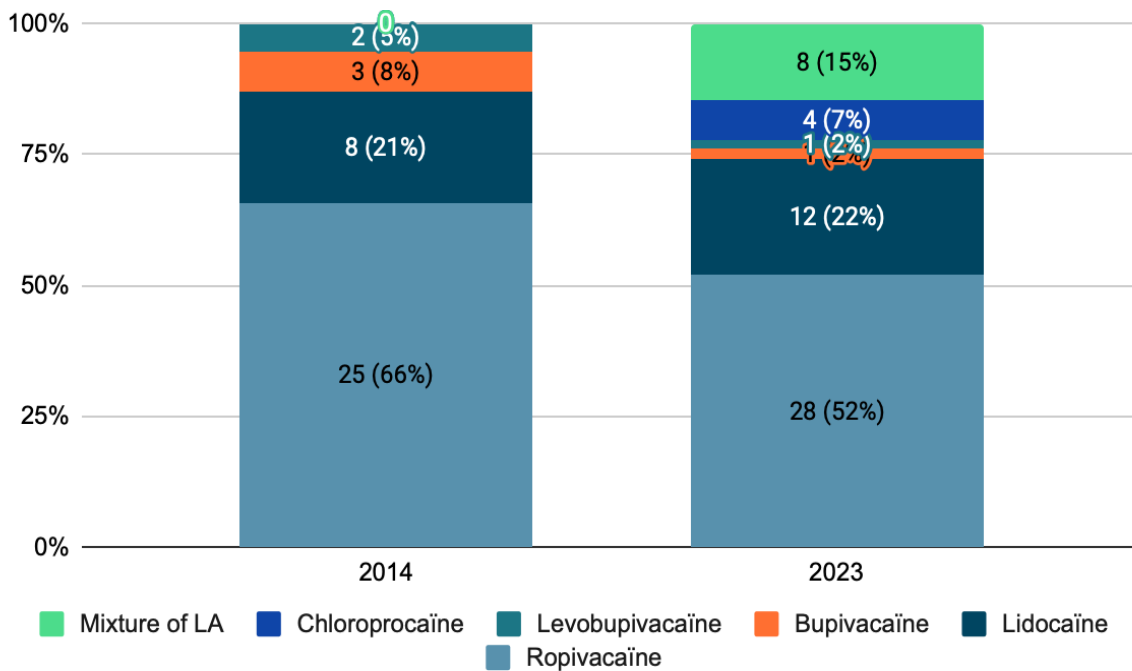


Fig. 8 — Local Anaesthetic in epidural top-up for CS.

sufentanil is more popular (63%). Orotracheal intubation is almost unanimously (98%) performed when performing a GA for CS, with only 1 center opting for a supraglottic airway device in a minority of cases (10%).

### 3) Aspiration prophylaxis (51 responses)

A strong majority (84%; 43) always provide aspiration prophylaxis. Most frequently used products are oral antacids by 36% (38), proton pump inhibitors by 26% (27), gastric prokinetics by 24% (25) and H2-receptorantagonists by 13% (14). Most hospitals use a combination of these

products. Compared to 2014, H2-antagonist usage has declined by almost 30%. However, proton pump inhibitors were not mentioned in 2014.

### 4) Antibiotic prophylaxis (51 responses)

Standard administration of antibiotic prophylaxis during CS, either with cefazoline or clindamycin, is done by 80% of centers, compared to 69% in 2014. The moment of administration differs significantly compared to 2014. 90% of hospitals administer antibiotics before incision of the skin, while in 2014 almost half of hospitals reported giving antibiotics only after clamping of the umbilical cord.



### 5) Uterotonics (50 responses)

To provide uterine contraction after delivery of the newborn(s), a strong shift towards carbetocin as the standard uterotonic agent is observed compared to 2014. 56% of centers now report it as their first choice, while only 28% in 2014. Methylergometrine was not mentioned anymore, while still being practiced by 9% in 2014. Continuous administration of uterotonics in the hours after CS is done 'always' or 'most of the time' by respectively 25% and 22%, while 49% 'almost never' and 4% 'never' give uterotonics in the hours after CS.

### 6) Management of hypotension (50 responses)

#### a) Prevention of hypotension

Measures to prevent maternal hypotension associated with neuraxial anesthesia for CS are almost unanimously performed (98%; 49). Strategies used were left lateral tilt of the parturient (37%; 47), administration of IV fluids (36%; 45) and the use of vasopressors (26%; 33). Positioning the parturient in anti-Trendelenburg was mentioned by 1 center. Regarding left lateral tilting of the patient, the angle of tilting varied greatly and 30% of centers did not know the exact angle applied. For fluid loading, crystalloid fluids are now clearly preferred over colloid fluids, with 80% versus 20% respectively, while in 2014, the use was evenly spread (48% versus 52%). No hospital reported giving albumin-based fluids. The most reported administered volume was 500ml (64%; 29). More than half of centers (58%; 26) administer fluids as a 'pre-load' before placing neuraxial anesthesia, while 40% (18) have fluids running during placement of the neuraxial anesthesia as a 'co-load'. Only 1 center administers fluids after placement of neuraxial anesthesia. When vasopressors are given for prevention of hypotension, 59% (27) of centers choose phenylephrine, 17% (8) choose either phenylephrine or ephedrine, depending on the maternal heart rate (ephedrine when < 60 bpm) and 9% (4) choose ephedrine as a standard. A combination of vasopressors (not further specified) is used by 13% (6) and 1 center uses norepinephrine as a standard. Administering intermittent boli is noticeably preferred over continuous infusion for vasopressors (76% versus 24%) and a majority (82%) waits until neuraxial anesthesia has been placed before administering vasopressors.

#### b) Treatment of hypotension

'Systolic blood pressure' and 'mean arterial pressure' are almost equally selected (48% vs 52% respectively) as the main parameter for defining 'spinal anesthesia-induced hypotension'. When compared to prevention of hypotension, vasopressors become more important (46%; 23),

followed by administration of IV fluids (34%; 17) and left lateral tilting of the parturient (20%; 10). As for prevention of hypotension, phenylephrine as a standard is also the most reported response (64%), followed by 'either phenylephrine or ephedrine depending on the maternal heart rate' (19%), 'a combination of vasopressors' (11%) and 'ephedrine as a standard' (6%). Norepinephrine was not mentioned for treating hypotension. An overwhelming majority (94%) also administers intermittent boli, while only 6% use a continuous infusion of vasopressors. Fluid administration is preferably done with crystalloids (86%) than with colloids (14%) and 500ml is the most reported administered volume as well (62%). The answers of the angle of left lateral tilt applied were also too heterogeneous in the treatment section.

### Post-CS analgesia

#### 1) Analgesia protocol (50 responses)

A vast majority (86%; 43) utilize a standardized analgesia protocol for treating post-CS pain and 95% of them claim that their protocol is applied almost every time by the attending and resident anesthesiologists in their hospital.

#### 2) Oral/parenteral analgesics (50 responses)

Almost every hospital (98%; 49) uses at least 1 oral and/or IV analgesic agent for treating post-CS pain. A description of the used products and their percentages is summarized below. In total, 9 hospitals (18%) reported using a combination of paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs), weak opioids and strong opioids. Except 1, all of them claim to follow the WHO pain ladder guideline.

#### a) Paracetamol

Paracetamol is almost unanimously (98%; 49) incorporated in post-CS analgesia protocols, which is the same percentage as in 2014. It is already administered intra-operatively (during the CS) by 76% (37). It is administered systemically (every 6 hours) by 92% (45), while 8% (4) only administers it when parturients indicate to experience pain. The majority (56%; 25) prescribes paracetamol for 24-48h after the CS, while 4% (2) prescribes it for less than 24h and 40% (18) prescribes it for more than 48h.

#### b) NSAIDs

Today, almost all hospitals (96%; 48) administer NSAIDs as well 96% (48), while this was slightly less in 2014 (83%). Ibuprofen is the most common agent (62%; 33), followed by diclofenac (23%; 12), ketorolac (15%; 7) and parecoxib (2%; 1). About half (53%; 25) already administer NSAIDs

intra-operatively and 69% (33) give them systematically. The majority (70%; 23) prescribe NSAIDs for 24-48h after CS, while 27% (9) prescribes them for more than 48h and 3% (1) for less than 24h.

#### c) Weak opioids

Opioids with partial agonist effects (e.g. tramadol, codeine) are given by 64% (32); while this was only done by 19% in 2014. In contrast with paracetamol/NSAIDs, only 1 center (3%) reported administering them intra-operatively. Almost all (90%; 26) choose an 'immediate release' (IR) preparation of weak opioids, while 7% (2) prefer an 'extended release' (ER) preparation and 3% (1) use a combination of both preparations. For each of these subgroups, it is noted that weak opioids are almost exclusively given only when parturients indicate to experience pain. Only 1 respondent states to give IR preparations systematically and prescribes them for 24-48h after CS.

#### d) Strong opioids

Opioids with full agonist effects (e.g. morphine/oxycodone/fentanyl) are given by 34% (17) compared to 22% in 2014. No hospital reported administering them already intra-operatively. IR preparations are prescribed by 94% (15), while 6% (1) prescribe ER preparations. A combination of both IR and ER preparations for strong opioids was not reported. As for weak opioids, only 1 center reports prescribing strong opioids systematically and does this for less than 24h after CS.

#### e) Dexamethasone

Dexamethasone is given by 26% (13) of hospitals with a standard dose of 5-10mg (only 1 center giving less than 5mg and no centers giving more than 10mg). Most of them (92%; 12) administer it already intra-operatively, but usually only after cross-clamping of the umbilicus (75%; 9).

#### 3) Neuraxial analgesia

Less than half of hospitals (42%; 21) include neuraxial analgesia in their protocol for treating pain after a CS. Administration of epidural LAs is, with 71% (15), still the most reported form of neuraxial analgesia, but is halved when compared with 2014. Epidural (dia)morphine is administered by 4 (compared to 6 centers in 2014) and 2 centers inject morphine intrathecally, which is still the same as in 2014. In the group that administers epidural LAs, 53% (8) use a PCEA+CEI regime, 40% (6) use PCEA alone and 7% (1) use CEI alone. In the epidural (dia)morphine-group, 3 out of 4 hospitals give (dia)morphine as a standard,

while 1 hospital administers it only when the parturient has a history of a severe pain after a CS. Only 1 hospital gives (dia)morphine already at the start of the CS and all hospitals prescribe it for less than 24u after. Sadly, the two hospitals that inject spinal morphine and/or sufentanil, did not disclose more details.

#### 4) Regional techniques

Locoregional infiltration is performed by 12% of hospitals. For 83% (10) this is in the form of local wound infiltration, while 1 hospital performs a Quadratus Lumborum (QL) block, and another hospital performs a Transversus Abdominis Plane (TAP) block. In 2014 still 19% of practices used a TAP block with a blind or an ultrasound guided technique. Almost all (83%; 10) of locoregional infiltrations are done as a standard, while 2 centers only perform them when the parturient indicates experiencing pain. As for the LAs, 67% (8) use ropivacaine, 25% (3) use bupivacaine and 1 hospital (8%) use levobupivacaine.

#### Discussion

We have performed a survey of obstetric anesthesia practice in Flanders, Belgium to evaluate practice related to labor analgesia, anesthesia for CS and post-CS pain relief. With a response rate of 91%, the results of this survey are deemed representative and reliable comparisons can be made regarding obstetric anesthesia practices in Flanders over time, as well as with other countries.

While annual deliveries continue to decline in the Flanders region, except in 2021, performance of locoregional anesthesia for labor has increased to almost 75% of all parturients<sup>4</sup>. A similar trend is observed in the rest of Europe<sup>5</sup>, however neuraxial analgesia rates are still significantly lower in the Netherlands and in the UK, with 21.5% (in 2018) and 21% (in 2014) respectively<sup>6,7</sup>.

Although the Belgian guidelines for obstetric anesthesia by the Belgian Association for Regional Anesthesia (BARA) were last reviewed in 2013<sup>8</sup>, other international guidelines, such as the PRACTICE Guidelines for Obstetric Anesthesia by the American Society of Anesthesiology, have been updated since the last survey of 2014<sup>9</sup>. Also in 2021, the PROSPECT guideline for postoperative pain management after elective CS was published<sup>10</sup>. Hence, this survey is valuable in evaluating the alignment between the recommendations outlined in these guidelines and their implementation within routine obstetric anesthesia care in the Flanders region.

## *Analgesia for Labor*

As in 2014, placement of a classic epidural is still the most widespread used technique for initiation of labor analgesia, however the CSE technique has gained significant popularity. While the CSE technique is associated with faster onset of analgesia and a reduced need for rescue analgesia, no differences are observed in maternal, neonatal and mobilization outcomes<sup>11</sup>. Furthermore, CSE analgesia is associated with a higher risk of non-reassuring fetal heart rate (FHR) tracings when compared with epidural analgesia. This has been attributed to catecholamine suppression with loss of tocolytic effect leading to uterine hypertonus<sup>12</sup>. However, it is unlikely that the higher incidence of non-reassuring FHR tracings is associated with a greater risk of CS<sup>13</sup>. The routine administration of a test dose to detect accidental intrathecal or intravascular placement of the epidural catheter continues to become less frequent. This reflects the current consensus that, when using low-dose, low-concentration solutions of LAs, as is recommended for labor analgesia, test doses are not required. However, parturients should always be closely monitored after initiation of neuraxial analgesia and re-evaluation by an anesthesiologist is recommended before commencement of an analgesia maintenance regime. It is important to note that, if a test dose is administered, it should not exceed the dose required for spinal anesthesia for CS<sup>14</sup>.

Ropivacaine remains the primary choice for both initiation and maintenance of labor analgesia as well as for CSE and conventional epidural technique. Levobupivacaine is the other predominant LA and is slightly more used in the CSE group (12% vs 32%). As outlined in the article by Versyck et. al. (2014), both ropivacaine and bupivacaine offer comparable pain relief and maternal satisfaction, with no discernible differences in obstetric or neonatal outcomes<sup>2</sup>. While ropivacaine is believed to induce less motor blockade and exhibit lower cardiotoxicity than (levo)bupivacaine, these distinctions are considered clinically negligible within the customary dose range used for labor analgesia<sup>15</sup>. Although current guidelines do not explicitly favor one LA over another, there is consensus advocating the use of diluted LA solutions in combination with opioids to minimize motor blockade<sup>9</sup>. Nowadays, nearly all centers employ concentrations not exceeding 0.2% and sufentanil is added in over 84% of cases overall (94% in epidural group, 68% in CSE group), which is a significant improvement compared to 2014.

Maintenance of analgesia is still mostly performed with a PCEA (+/- CEI) program, however PIEB (+/- PCEA) is being more and more incorporated into practice (although still less than 25%). Manual top-up and CEI without bolus are still preferred by a small, but non negligible group of anesthesiologists. Except for the programmed bolus in the PIEB-group, respondents reported administering rather small volume boli (< 5ml) in the PCEA and manual top-up group. In addition, continuous infusion rates are also low when combined with PCEA. In recent years, a myriad of evidence has appeared demonstrating the superiority of PIEB (with or without PCEA) over CEI (with or without PCEA) as it offers more effective pain relief with less breakthrough pain, reduces motor block, potentially lowers the risk of instrumental delivery, and improves overall maternal satisfaction<sup>16-21</sup>. This has been attributed to the fact that PIEB provides better LA spread in the epidural space and better sensory blockade. However, most studies did not correct for differences in administered bolus volumes between the two groups, leading to conflicting data regarding total LA consumption. In 2023, Roofthoof et al demonstrated that high-volume PCEA (without continuous) infusion is non-inferior to PIEB for maintenance of labor analgesia, with PIEB providing more consistent analgesia (less variability), whereas PCEA is associated with less LA consumption and may give women more control over their pain (and so a higher degree of satisfaction)<sup>22</sup>. Overall, we strongly advocate Flemish hospitals to implement 'high-volume bolus' regimes for maintaining labor analgesia, whether this is with PIEB or PCEA, and to discontinue the practice of CEI-based regimes.

Non-neuraxial analgesia is still offered as an alternative for managing labor pain by roughly one third of centers, primarily in cases where neuraxial analgesia is contraindicated—an occurrence observed in less than 1% of all labor instances. Among these alternatives, IV tramadol stands as the most frequently employed method for non-neuraxial analgesia. However, 4 hospitals declared providing IV remifentanil as well. Literature suggests that remifentanil PCA, although consistently inferior to neuraxial analgesia, is the most favorable alternative for labor pain. Nevertheless, substantial safety concerns persist due to reported incidents of respiratory depression, hypoxia, and, in severe cases, cardiac arrest associated with its use<sup>23,24</sup>. When justified, the use of remifentanil demands strict adherence to precautionary measures and safety protocols, which all centers declared to do so.

Other findings such as NPO restrictions and prophylactic fluid bolus administration ('preloading') for neuraxial labor analgesia are



comparable to the 2014 survey. While ingestion of 'clear liquids only' during active labor is still recommended, some evidence has appeared in favor for less-restrictive intake policies in cases of low-risk singleton gestations, as the incidence of vomiting and/or aspiration is not increased, while maternal views and feelings of control are improved<sup>25,26</sup>. The relevance of preloading has also been questioned since multiple studies failed to show a statistically significant decrease in maternal hypotension when IV fluids were omitted before epidural placement. It may however be beneficial for FHR tracings since abnormalities are more present when preloading is not performed<sup>27</sup>.

### *Anesthesia for CS*

Contrary to prior studies regarding the preferred neuraxial technique for CS, we distinguished between primary (elective) CS and secondary (unplanned and/or emergency) CS in this survey.

CSE remains the predominantly used technique for primary and secondary CS when the parturient did not receive neuraxial analgesia yet (e.g. no epidural catheter in place). However, it is noteworthy that SSS continues to retain a significant position, particularly for secondary CS. The advantages of the CSE technique of providing reliable anesthesia with the spinal component and having an epidural catheter in place for rescue anesthesia, allows for reducing the intrathecal LA dose and thereby decreasing the incidence and severity of maternal hypotension<sup>28</sup>. However, there currently is insufficient evidence to support the CSE technique over SSS, since existing comparative studies are small and have significant design limitations<sup>29,30</sup>. Regardless of the neuraxial technique, hyperbaric bupivacaine 0.5% has firmly established itself as the leading LA choice, as it remains the international gold standard for spinal anesthesia during CS. However, several comparative studies concluded that levobupivacaine, ropivacaine and prilocaine offer comparable anesthetic efficacy and reliability, while facilitating faster recovery times and lower incidences of maternal hypotension and bradycardia<sup>31-36</sup>. Nevertheless, the quality of evidence of these studies is low, due to small sample sizes.

Converting from epidural labor analgesia to neuraxial anesthesia for secondary CS is almost exclusively done by epidural 'top-up' through the indwelling catheter. In this instance, ropivacaine 0.75% is the primary choice, although 2-chloroprocaine 3% and lidocaine 2% are also frequently mentioned. All three solutions have demonstrated effectiveness in providing anesthesia for CS. However, lidocaine 2% (with epinephrine and/or bicarbonate), as well as 2-chloroprocaine

3%, exhibit faster onset times, making them preferable for emergent (category 1) CS<sup>37</sup>. On the contrary, ropivacaine 0.75% is linked to a decreased requirement for intraoperative supplementation and is considered optimal in scenarios where there is less time pressure<sup>38</sup>.

We are pleased to see that GA for CS is only performed in category 1 cases, as it is well established by now that neuraxial anesthesia is associated with better maternal and fetal outcomes. Propofol and rocuronium is the standard combination for induction of GA in hemodynamically stable parturients. Opioids are generally avoided at induction and postponed until umbilical cord clamping and sufentanil is then preferred. However, in cases where opioids are administered during induction, remifentanil takes precedence. Ensuring a secure airway through orotracheal intubation with application of cricoid pressure is almost unanimously practiced. These findings align closely with the current recommendations on GA for CS<sup>39</sup>.

However, since the introduction of short-acting opioids, the general reluctance for admission of opioids prior to cord clamping has been questioned. A 2019 systematic review concluded that both remifentanil and alfentanil are not associated with lower neonatal Apgar-scores or increased neonatal airway interventions<sup>40</sup>. Furthermore, remifentanil is associated with enhanced maternal hemodynamic stability, attenuating the circulatory response to intubation and surgery, as well as a potential reduction of the risk of awareness<sup>39</sup>. Current expert opinion therefore states that remifentanil given at induction of GA for CS is safe for both mother and baby and offers significant benefits as compared with opioid-free or delayed opioid administration techniques<sup>41</sup>.

Most anesthesiologists take measures to prevent and manage maternal hypotension associated with neuraxial anesthesia during CS. Left lateral tilting and fluid administration with crystalloid fluids are the preferred preventive strategies. There continues to exist controversy regarding the timing (preloading vs co-loading) and type (crystalloids vs colloids) of fluid administration for management of spinal-induced hypotension. Currently, colloid preloading seems to be slightly in favor<sup>42</sup>. However, quality of evidence is low, and the incidence of hypotension remains significant. Consequently, adopting the most economical approach remains justifiable. Vasopressors are more reserved for the treating hypotension. Phenylephrine is prominently favored as the standard choice, yet a minority decides between phenylephrine and ephedrine depending on maternal heart rate. In this instance,

phenylephrine enjoys a clear preference, as ephedrine is associated with worse fetal-acid base status<sup>43</sup>. In recent years, new evidence has emerged promoting the use of prophylactic continuous infusion of phenylephrine over intermittent bolus administration, showing a reduced incidence of hypotension and fewer maternal side effects (including nausea and vomiting)<sup>44</sup>. This information appears relatively unknown to the Flemish anesthesiologists as the utilization of continuous phenylephrine infusion was rarely mentioned in our survey. A clear message to the Flemish anesthesia community is therefore to adopt the preferred and internationally recommended recommendation to use prophylactic, continuous phenylephrine infusions to prevent and manage spinal induced hypotension<sup>44</sup>.

For prevention of uterine atony and subsequent postpartum hemorrhage, carbetocin and oxytocin are currently employed with equal frequency. Existing guidelines do not favor a specific uterotonic as they share the same mechanisms of action and adverse effects are comparable, but carbetocin is a longer-acting analogue and eliminates the requirement for a continuous infusion after the initial dose, which makes it potentially preferable<sup>45</sup>.

Furthermore, administration of aspiration and antibiotic prophylaxis during CS remain commonly practiced as they are still recommended by regional and international guidelines. Regarding aspiration prophylaxis, considerable heterogeneity exists regarding the reported types of drugs and combinations used for this (e.g. oral antacids, PPI's, gastric prokinetics and H2-antagonists), which is reflected by the ambiguity in current literature<sup>46</sup>.

### *Post-CS analgesia*

At the time of the previous inquiry, the predominant techniques for managing postoperative pain after CS were epidural analgesia using LAs through CEI and/or PCEA, alongside systemic analgesia, such as parenteral or oral opioids.

In 2021 the PROSPECT-guideline was released, promoting enhanced recovery after surgery, and providing an optimal analgesia strategy after CS<sup>10</sup>. In this review 126 RCT's and 19 meta-analyses were assessed, and each pain intervention was carefully examined by a team of anesthesiologists and surgeons to assess the procedure-specific evidence, risk and benefits and utility in context of modern perioperative analgesia protocols. As a result, a multimodal analgesic approach was formulated including a combination of systemic analgesia as well as infiltration techniques<sup>10</sup>. In the next section, we will compare our survey results with these recommendations.

Systemic paracetamol and NSAIDs are the basic analgesics that should always be included, unless formally contraindicated. They should be started intra-operatively and administered systemically (rather than 'on request'), since they are proven to reduce the need for rescue opioids. With a positive response of over 95% for both agents, the Flemish anesthesiologists adhere well to these recommendations, although NSAIDs should be given more intra-operatively as well.

IV dexamethasone is a novice recommendation, as studies have demonstrated its efficacy not only as an antiemetic but also as an effective analgesic for CS. The current recommended dose ranges from 5 to 10mg, but higher doses are being investigated as well. It is important to exercise caution in patients with glucose intolerance, a prevalent issue in the obstetric population<sup>47</sup>. The novelty of this recommendation is reflected in our survey results, as it was mentioned by only a quarter of the respondents.

The PROSPECT guideline continues to endorse the use of neuraxial (dia)morphine for achieving prolonged analgesia after CS. However, lower doses are recommended than previously common, as this reduces side effects while adequate analgesia is still maintained<sup>48,49</sup>. In contrast to these findings, neuraxial opioids remain an unpopular strategy among Flemish anesthesiologists. We believe that this hesitancy is influenced by persistent stigmas associated with a historically high incidence of unpleasant side effects, such as pruritus, as well as safety concerns, particularly regarding respiratory depression and the need for higher monitoring safety standards<sup>47,50</sup>.

When neuraxial opioids are not administered, an alternative regional anesthesia technique should be considered. Local wound infiltration (with or without continuous wound infusion), transversus abdominis plane block, quadratus lumborum block, ilio-inguinal or ilio-hypogastric nerve block and erector spinae block have all been described as effective methods for providing analgesia in the absence of intrathecal morphine<sup>51</sup>. On the contrary, when intrathecal morphine is already administered, adding another regional technique does not provide an additional advantage<sup>10</sup>. As only 1 in 5 of centers performs a regional technique and the use of neuraxial opioids is limited as well, this indicates that substantial improvement can be made in this area.

Furthermore, continued epidural administration of LAs with PCEA and/or CEI is no longer recommended, due to limited procedure-specific evidence, concerns of potential side-effects and reduced mobility and prolonged need for



bladder catheterization. Despite observing a 50% reduction compared to 2014, this practice remains relatively common in Flanders. The convenience of having an indwelling epidural catheter after performing a CSE or epidural top-up for CS and not having to perform a secondary regional technique, is presumably the main reasoning for this. Nevertheless, its use should be discouraged as it is shown to be less effective than intrathecal or epidural morphine and results in more side-effects and prolonged hospitalization<sup>52</sup>.

Systemic opioids should be reserved for use as rescue analgesia or when regional anesthesia is contraindicated. Additionally, compliance to the WHO pain ladder is crucial when administering opioids. This entails starting with non-opioid analgesics as the basics, incorporating weak opioids when basic analgesics are insufficient, and resorting to strong opioids only as a last resort. Despite the increased prescription of opioids compared to 2014, almost all centers follow the instructions as outlined above. We hypothesize the increased use of opioids is correlated with the witnessed decrease in epidural analgesia.

It is important to note that the PROSPECT guideline is restricted for elective CS under neuraxial anesthesia, since emergency CS or CS performed under general anesthesia were not taken into consideration for this guideline.

## Limitations

The present study is subject to several limitations. Firstly, the extensiveness of the survey and the detailed nature of certain questions resulted in a significant number of incomplete data points. The inclusion of open-ended questions, particularly those related to product dose, concentration, volume, and additives, added to the challenge of obtaining comprehensive information.

Secondly, there is a potential risk that respondents may have provided more desirable but inaccurate answers due to the fear of portraying their department in a negative light. This introduces a potential bias in the data.

Thirdly, as our participant pool consisted of only 1 anesthesiologist per department, the true representation of results might be skewed, as many hospitals may lack standardized protocols for obstetric anesthesia.

Lastly, meaningful data comparisons were not always feasible due to the lack of exact numerical displays in the previous inquiries, limiting the ability to make direct comparisons and draw definitive conclusions.

## Conclusion

In this follow-up study we inspected the current landscape of obstetric anesthesia in the Flanders region and assessed how it aligns with the latest evidence and guidelines. Our findings demonstrate that Flemish anesthesiologists continue to modernize their practices, with significant developments observed since the previous inquiry in 2014. For labor analgesia, the growing popularity of CSE and PIEB are highlighted, but ‘high-volume’ bolus regimes for maintenance should be encouraged more as low-volume PCEA (+/- CEI) remains a common method. Anesthesia for CS is largely performed according to current gold standards, although continuous phenylephrine infusion for management of hypotension is a recent recommendation that has not yet become standard practice. Furthermore, while PCEA for post-CS analgesia has already decreased significantly, a further shift towards regional techniques or neuraxial opioids in combination with paracetamol, NSAIDs and IV dexamethasone is desirable to minimize systemic opioid consumption.

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