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YEAR IN REVIEW

A year in review in *Minerva Anestesiologica* 2023:
anesthesia, analgesia, and perioperative medicine

Franco CAVALIERE^{1*}, Massimo ALLEGRI², Alparslan APAN³,
Luca BRAZZI⁴, Massimiliano CARASSITI⁵, Edmond COHEN⁶,
Pierangelo DI MARCO⁷, Olivier LANGERON⁸, Marco ROSSI¹,
Peter SPIETH⁹, David TURNBULL¹⁰, Frank WEBER¹¹

¹IRCCS A. Gemelli University Polyclinic Foundation, Sacred Heart Catholic University, Rome, Italy; ²Lemanic Center of Analgesia and Neuromodulation EHC, Morges, Switzerland; ³Department of Anesthesiology and Intensive Care, Faculty of Medicine, University of Giresun, Giresun, Türkiye; ⁴Department of Surgical Sciences, University of Turin, Turin, Italy; ⁵Unit of Anesthesia, Intensive Care and Pain Management, Campus Bio-Medico University Hospital, Rome, Italy; ⁶Department of Anesthesiology, Icahn School of Medicine at Mount Sinai, New York, NY, USA; ⁷Department of Cardiovascular, Respiratory, Nephrologic, Anesthesiologic, and Geriatric Sciences, Faculty of Medicine, Sapienza University, Rome, Italy; ⁸Department of Anesthesia and Intensive Care, Henri Mondor University Hospital, Assistance Publique - Hôpitaux de Paris (APHP), University Paris-Est Créteil (UPEC), Paris, France; ⁹Department of Anesthesiology and Critical Care Medicine, University Hospital of Dresden, Dresden, Germany; ¹⁰Department of Anesthetics and Neuro Critical Care, Royal Hallamshire Hospital, Sheffield, UK; ¹¹Department of Anesthesiology, Sophia Children's Hospital, Erasmus University Medical Center, Rotterdam, the Netherlands

*Corresponding author: Franco Cavaliere, IRCCS A. Gemelli University Polyclinic Foundation, Sacred Heart Catholic University, largo Francesco Vito 1, Rome, Italy. E-mail: f.cavaliere@rm.unicatt.it

General anesthesia

Have we already achieved the target of an ideal intravenous anesthetic available? Remimazolam may be a near-ideal sedative with steady hemodynamics, rapid onset and recovery, mild respiratory depression, low post-operative nausea and vomiting (PONV), and low hepatic and renal toxicity. Furthermore, it is not metabolized through the cytochrome-dependent liver pathway and does not accumulate during long-term infusion.¹ In the June issue, Wu *et al.* reported the results of a systematic review and meta-analysis comparing remimazolam and propofol safety for general anesthesia.² The authors reviewed eight randomized controlled trials involving 998 patients pointing out that the former offered a lower incidence of hypotension, hypoxemia, PONV, dizziness, and pain in the injection site.

Compared with racemic ketamine, the enantiomer esketamine has a higher affinity for NMDA receptors and is twice more potent with fewer side effects.³ Huang *et al.* evaluated the effect of esketamine in combination with propofol with a systematic review and meta-analysis published in the July-August issue.⁴ Data from seven RCTs and 808 adult patients showed that combining the two drugs was associated with fewer hypotensive and bradycardic episodes and less propofol consumption compared with other anesthetics. Conversely, there was no advantage in recovery time, respiratory depression, and PONV incidence, and a higher risk of postoperative agitation.

Dexmedetomidine (DEX) and remifentanyl are widely used for surgical procedures performed under sedation.^{5,6} Monaco *et al.* compared the two drugs for complex endovascular aortic aneurysm repair in a retrospective study published

in April.⁷ Of 79 consecutive patients, the 37 ones who received DEX were more deeply sedated, expressed a lower degree of satisfaction, and needed vasopressors more frequently. Arterial hypotension was a particularly undesirable effect in endovascular aortic aneurysm repair because mean arterial pressure is crucial to preserve spinal cord perfusion. Hence, the authors concluded that remifentanyl was the anesthetic regimen of choice.

Intraoperative arterial hypotension may produce significant adverse effects, particularly in high-risk patients, and its prevention is crucial in anesthetic management.⁸ Gulasti *et al.* offered a new tool to anticipate the risk of significant arterial hypotension at anesthesia induction by showing that a preoperative TAPSE value lower than 2.5 cm at preoperative transthoracic echocardiography predicts the risk of arterial hypotension with reasonable accuracy. The study, published in April, included 47 adult patients without known cardiovascular disease scheduled for elective surgery.⁹ Another interesting tool is the Hypotension Predictive Index (HPI), which is calculated from the analysis of the radial artery pressure curve and is aimed to anticipate the risk of an imminent drop in blood pressure ranging from zero to 100.¹⁰ Pouska *et al.* carried out a pilot study by randomizing 40 patients to receive HPI monitoring or not during supratentorial brain surgery.¹¹ Their report, published in June, confirmed that HPI assessment may significantly decrease the rate of hypotensive episodes.

In September, MA published an update by Hernandez-Meza and Gainsburg on the optimal anesthetic management of patients who undergo prostate robotic surgery. The authors focused on the effects of steep Trendelenburg position and CO₂ pneumoperitoneum and the prevention of possible complications, such as venous gas embolism and ischemic optic neuropathy.^{12, 13} The effects of the Trendelenburg position were also investigated by Fogagnolo *et al.*, who analyzed the occurrence of expiratory flow limitation (EFL) during gynecological procedures.¹⁴ In their study, 25 patients out of 66 undergoing elective laparoscopic gynecological surgery developed EFL. Its occurrence was associated with poorer respiratory mechanics during surgery and

higher rates of hypercapnia and pulmonary complications postoperatively.

In the July-August issue, Messina *et al.* applied a cluster analysis to 233 elective surgical patients from five merged datasets. They identified three clinical phenotypes based on the response to a fluid challenge, which were 1) flow and pressure responders; 2) flow and pressure non responders; 3) flow responders and pressure non responders.¹⁵ The analysis also pointed out that pulse pressure variation (PPV) was poorly reliable in predicting fluid responsiveness so that, in agreement with others, the authors recommended using a combination of hemodynamic values rather than a single parameter.¹⁶

Medical applications of artificial intelligence (AI) are growing exponentially, and with them, the related literature.¹⁷ In September, the SIAARTI research group in new technologies offered the readers a selection of the ten outstanding articles on AI uses in Anesthesia chosen with a cross-evaluation by the Board members between those published in the last five years.¹⁸

The quality of preoperative information, such as the choice between anesthesia and postoperative analgesia techniques and their respective risks, or the fasting rules, affects patient satisfaction strongly.¹⁹ In April, MA published an article by Bronnert *et al.*, who assessed whether additional information delivered by a humanoid robot in the waiting room before the preoperative visit improved patients' overall satisfaction.²⁰ Their results failed to point out any significant difference in patients' satisfaction before and after the introduction of the robot, except for the perceived information about operatory risks, which improved.

Patients undergoing elective cesarean section are at increased risk of aspiration of gastroesophageal contents, which is one of general anesthesia's significant complications.^{21, 22} MA published two articles that confirmed how ultrasound can provide anesthetists with useful bedside information on patients' gastric content.^{23, 24} Russet *et al.* compared the gastric volume after overnight fasting in pregnant patients undergoing elective c-sections and non-pregnant patients undergoing hysteroscopy.²⁵ The comparison was based on the antral cross-sectional area val-

ues, which were significantly larger in pregnant women; however, the degree of concordance of that parameter with other ultrasound parameters utilized in the literature was only “slight or at best fair.” In June, another article on the risk of pulmonary aspiration at the anesthesia induction was authored by Hamed *et al.*²⁶ With ultrasound, they tested metoclopramide efficacy in reducing the gastric volume in 111 patients scheduled for elective cesarean section and randomized to receive metoclopramide or saline one hour prior to anesthesia induction. Gastric volume was significantly less, and PONV incidence was lower in the intervention group.

Tracheal intubation constitutes a powerful stimulus that may increase intracranial pressure and jeopardize brain perfusion in the presence of insufficient depth of anesthesia.^{27, 28} In February, MA published an article by Maissan *et al.*, who monitored the optical nerve sheath diameter as an indicator of intracranial pressure before and after tracheal intubation in 60 patients scheduled for elective surgery.²⁹ The study showed that the optical nerve sheath diameter increased for at least 20 minutes after tracheal intubation, and lidocaine administration might partly prevent such an increase.

Two interesting articles dealt with nociception monitoring. In January, a systematic review and meta-analysis by Hung *et al.* investigated whether nociception index availability might decrease intraoperative opioid dosages.³⁰ Data collected from six studies and 399 patients did not support such a hypothesis, nor were significant effects found in secondary targets, which included postoperative opioid consumption, pain score, emergence time, and PONV incidence. In October, Yu *et al.* reported a significant decrease in remifentanyl doses by monitoring pupil dilation reflex for intraoperative pain assessment.³¹ In 80 patients who underwent laparoscopic hysterectomy or myomectomy, those whose pupil dilation reflex was monitored had shorter times to tracheal tube removal, lower NRS scores, and lower PONV incidence.

Postoperative delirium (POD), one of the most common postoperative complications, may cause cognitive disorders, memory disturbances, and increased length of recovery and hospitaliza-

tion.³² In the May issue, Eckert *et al.* reported on the association of POD and chronic pain development (pain lasting six months or longer after surgery).³³ In 176 patients scheduled for elective surgery, no relationship was found between POD (observed in 22% of patients) and chronic postoperative pain after adjusting for ASA class, anxiety scores, and anesthesia duration. In the subgroup of 69 patients already suffering from chronic pain before surgery, 12 developed POD (17%) and complained of significantly greater pain than the others six months after surgery.

Airways

Airway management was extensively covered by MA in 2023. In the June issue, Yan *et al.* proposed a prediction model for difficult airways in patients affected by obstructive sleep apnea-hypopnea syndrome (OSAHS).³⁴ Given that difficult or failed tracheal intubation may lead to serious adverse events, predicting the risk and predisposing adequate management is essential.³⁵ The availability of simple nomograms, as proposed by the authors, may facilitate that task.

In the September issue, Li and Hang proposed a four-step procedure to optimize non-ventilated lung collapse during thoracoscopic surgery: 1) high-flow 100% oxygen to ensure denitrogenation; 2) switch to a mixture of 50% oxygen and 50% nitrous oxide after intubation; 3) start of one-lung ventilation when the patient is in lateral decubitus; 4) bronchial aspiration at the pleural opening.³⁶ Since the quality of non-ventilated lung collapse is crucial in video-assisted thoracoscopic surgery, the proposed approach could be helpful pending confirmatory studies.³⁷

Pai *et al.* evaluated the clinical efficacy, safety, and financial implications of replacing succinylcholine with high-dose rocuronium plus sugammadex to treat severe laryngospasm in outpatient facilities.³⁸ Both approaches were effective, but succinylcholine had a superior clinical and economic profile. These results supported the Authors' proposal of not necessarily having dantrolene available when succinylcholine availability is finalized only for emergencies.³⁹

In a meta-analysis by Hsieh *et al.* published in May, sugammadex given immediately after sur-

gergy was associated with a lower risk of PONV than neostigmine, especially in patients receiving volatile anesthetics and regardless of the prophylactic use of antiemetics.⁴⁰ These results may clarify the controversies in the literature regarding the risk of PONV associated with using the two antagonists of neuromuscular blockers.⁴¹

Pediatric anesthesia

Last year's pediatric anesthesiology publications in MA focused on patient safety and comfort, both in the short and long term.

In their meta-analysis on midazolam premedication published in April, Chen *et al.* showed that the onset time of nasal midazolam is shorter than that of the oral route but is associated with a higher incidence of nasal irritation.⁴² Fortunately, there are several (potential) alternatives: a midazolam nasal spray recently approved in the EU appears to cause less nasal irritation.⁴³ In addition, DEX premedication will likely play an essential role in the future, and non-pharmacological approaches are also rapidly evolving.^{44, 45}

Now that the long-term discussion about anesthetic-induced neurotoxicity has slowly calmed down, we are concerned with the question of a possible association between anesthesia in early childhood and autism. The current data situation on this topic is mixed,^{46, 47} making the study by Pikwer *et al.*, who found an association between anesthesia and autism an essential contribution to clarifying a question that is of great concern to many parents whose children have to undergo surgery.⁴⁸

Commercially available monitors based on processed electroencephalography to monitor the depth of anesthesia have long been standard equipment in many hospitals. Unfortunately, their applicability to young children is limited.⁴⁹ EEG density spectral array (DSA) offers real-time monitoring even in young infants. However, DSA is not self-explanatory and requires some knowledge regarding EEG and neuropharmacology. In April, with a practice-oriented article on the principles of DSA, de Heer and Weber invited pediatric anesthesiologists to start using this fascinating modern technology.⁵⁰

Regional anesthesia

During the last decade, fascial plane blocks have become increasingly popular in surgical scenarios, including thoracic, abdominal, and lower limb surgeries.⁵¹⁻⁵³ Recent research has led not only to implementing traditional fascial blocks but also to developing new ones.⁵⁴ The EXORA block described by Okmen in the December issue combines external oblique plane and rectus sheath blocks.⁵⁵ The author presented the results of a propensity-matched study on 60 patients undergoing laparoscopic cholecystectomy, where performing the EXORA block had a positive impact on postoperative pain and opioid consumption.⁵⁵

The erector spinae plane block (ESPB) has been widely utilized due to multiple pathways and mechanisms of action.^{56, 57} Last year, MA published a few interesting articles on randomized controlled trials concerning this block. In the January-February issue, Onay *et al.* reported that ESPB and lateral quadratus lumborum block (QLB) were comparable in postoperative pain scores at rest and movement, and morphine consumption after open nephrectomy.⁵⁸ In June, Fan *et al.* reported the non-inferiority of the ESPB *Vs.* the thoracic paravertebral block (PVB) to manage postoperative static pain in laparoscopic nephrectomy.⁵⁹ In March, Zengin *et al.* pointed out that ESPB provided better postoperative analgesia and less morphine consumption than thoracic PVB after thoracoscopic surgery, but the combination of the two blocks produced even better results.⁶⁰ Finally, in a narrative review published in October, Nisi *et al.* claimed a low or absent risk for ESPB in patients on antithrombotic therapy with a better risk profile than thoracic PVB.⁶¹ This statement was particularly noteworthy because recent guidelines advised against performing deep fascial blocks in patients who have not discontinued anticoagulant therapy.⁶²

The relative effectiveness of block techniques has been widely investigated.⁶³ Further contributions on this subjects included a randomized controlled trial by Kaya *et al.* on the analgesic effect of the anterior QLB compared to lumbar PVB in laparoscopic nephrectomies published in November; QLB provided similar levels of postoperative analgesia but with greater opioid con-

sumption.⁶⁴ In the September issue, Abo El Fadl *et al.* demonstrated that the transversus abdominis plane block, one of the first fascial blocks described in the literature, was more effective than a caudal block in pediatric patients undergoing inguinal hernia repair.⁶⁵ In a study published in October, Sciard *et al.* compared the postoperative analgesic efficacy of distal peripheral nerve blocks with surgical site infiltration after surgical repair of distal radius fractures; they concluded that pain control, the incidence of side effects, and patient's satisfaction were comparable.⁶⁶ Finally, in a systematic review that can be found in the December issue, Hu *et al.* compared the analgesic quality of the retrolaminar block with other traditional blocks.⁶⁷

Technical advances in ultrasound-guided regional anesthesia aim to improve anatomical structure visualization and make needle advancement safer.⁶⁸ In this regard, some regional techniques require redirecting the needle, which may increase tissue trauma and procedural pain. To overcome this problem, Wang *et al.* used curved needles while performing four-in-one block in elderly patients undergoing total knee arthroplasty; the report was published in April.⁶⁹

Predetermining the success of regional anesthetic techniques is especially important in busy surgical centers. For this purpose, changes in Perfusion Index due to vasodilation are considered one of the earliest signs of block success. A narrative review by Chu *et al.* on the subject was published in the July-August issue.⁷⁰

Severe perioperative pain may cause comorbidity and worsen life quality.⁷¹ The hemodynamic response to surgical maneuvers is also essential, particularly in neurosurgery. Luo *et al.* investigated the protective effect of the scalp nerve block on the hemodynamic response to the incision during craniotomy with a systematic review and meta-analysis available in the January-February issue.⁷² Zhang *et al.* investigated the efficiency of ultrasound-guided periarthral femoral nerve block in reducing tourniquet pain and hemodynamic response in conscious patients, concluding that it may improve tolerance to lower extremity surgery.⁷³

Long-term pain and nerve damage play a role in the genesis of chronic neuropathic pain,⁷⁴ and

regional anesthesia may offer an option to prevent or reduce chronic pain.⁷⁵ Since midline cutaneous incision may facilitate neuropathic pain development after total knee arthroplasty, Bjørn *et al.* delimited the areas anesthetized by blocking the anterior *versus* posterior branches of the medial femoral cutaneous nerve in a group of volunteers.⁷⁶ They found that the median surgical incision interested the territory of the anterior branch and proposed a novel technique to block that branch selectively.

Finally, we mention three articles on neuraxial anesthesia. In the May issue, a systematic review and meta-analysis by Via *et al.* compared α -2 agonists to fentanyl as adjuvants to local anesthetics for spinal anesthesia in elective cesarean section.⁷⁷ Compared to fentanyl, α -2 agonists were associated with longer sensory blocks, increased time to first rescue analgesia, and a lower incidence of shivering and PONV. These results align with the hypothesis that the activation of the intrathecal α -2-receptor has an antinociceptive action on somatic and visceral pain.⁷⁸ The effectiveness of ultrasound in predicting difficult spinal anesthesia (SA) was evaluated by Pascarella *et al.* with a prospective observational study.⁷⁹ They found that ultrasound was highly effective for visualizing the anterior dura mater, which is usually associated with easy SA; conversely, the inability to visualize the anterior dura mater may suggest the use of alternative techniques. Soliman *et al.* evaluated the efficacy of nebulized DEX *vs.* Saline and *vs.* a mixture of neostigmine and atropine for post-dural puncture headache (PDPH) relief in 90 patients.⁸⁰ More than 90% of those who received DEX fully recovered from headaches after two doses. Based on their results, the authors suggested that nebulized DEX is tried in PDPH even if current guidelines do not recommend it.⁸¹

Transplantation

Severe acute liver failure often has no treatment other than transplantation. Mesenchymal stromal cells (MSCs) may offer an alternative therapy because of their beneficial pleiotropic properties, but several obstacles derive from their cellular nature.⁸²⁻⁸⁴ In comparison, MSC-derived extra-

cellular vesicles (MSC-EVs) are innovative cell-free therapeutics for immunomodulation and regenerative purposes with the advantages of having pleiotropic effects, low immunogenicity, storage stability, good safety profile, and the possibility of bioengineering. In the July-August issue, Sitbon *et al.* reviewed the therapeutic potentials of MSC-EVs in liver failure and marginal liver graft rehabilitation.⁸⁵ The authors remarked that no human studies have been performed to explore the impact of MSC-EVs on acute liver failure currently. However, several preclinical studies highlighted their potential beneficial effects. In ALF and ACLF, MSC-EVs attenuate hepatic stellate cell activation and exert anti-oxidant, anti-inflammatory, anti-apoptosis, and anti-ferroptosis properties. In LF, MSC-EVs also demonstrated anti-fibrotic properties associated with liver tissue regeneration.

Arterial hypotension occurs frequently during liver surgery, particularly liver transplantation, predisposing to various complications, from acute kidney injury to myocardial infarction and death.^{86, 87} In the May issue, Yang *et al.* reported the results of a prospective observational study to evaluate HPI's performance in 20 liver transplant recipients.⁸⁸ Mean arterial pressure and HPI were recorded at 1-minute intervals during surgery. The area under the curve of the receiver operating characteristic curve was calculated for the whole dataset and at each phase of liver transplantation. HPI's accuracy in predicting arterial hypotension was moderate-to-low and inferior to that previously reported in other types of major surgery.

Perioperative medicine

Postoperative pulmonary complications (PPCs) occur in up to 40% of patients after major abdominal surgery, even more frequently than cardiac complications, and contribute to postoperative morbidity and mortality with millions of days more hospital stays and an additional economic burden.^{89, 90} In the November issue, Piccioni *et al.* reported the results of a large Italian multicenter study performed in 14 days on PPCs and related mortality after major abdominal surgery.⁹¹ Overall PPC rate was 12.6%, roughly in

line with previous reports, and respiratory failure incidence was 4.1%; general surgery had a higher risk of PPC development and ICU admission than gynecological and urological surgery; in-hospital mortality rate in the overall sample was 1%, much lower than 4% reported by the EUSOS Study (5.3% in Italy) in 2012. Patients with PPCs had mortality at one year about four times higher than the others.⁹² Another study concerned the role of laparotomy as a risk factor of PPCs based on decreased cough strength and diaphragmatic dysfunction by reflex inhibition of the phrenic nerve.⁹³ In December, Aguilera *et al.* reported on cough strength in 11 patients scheduled for open midline laparotomy, which was evaluated by measuring the pressure in the rectum with a compliance balloon catheter.⁹⁴ They found that thoracic epidural analgesia decreased cough strength while successive midline laparotomy did not. Postoperatively, cough strength remained stable in the presence of adequate analgesia provided by epidural bupivacaine.

Acute kidney injury (AKI) occurs after non-cardiac surgery with an incidence between 6 and 13% and is associated with prolonged hospital stay, increased mortality, and higher cost.^{95, 96} Postoperative AKI is defined and staged according to the criteria of increased serum creatinine by 50% in seven days or 0.3 mg/dL in two days, oliguria for more than six hours, and occurrence within seven days from surgery.⁹⁷ Retrospective studies suggested that low tidal volumes (TV) may be protective against AKI during mechanical ventilation because too high TV increases thoracic pressure and impairs venous return; the consequent reduction in cardiac output may cause renal perfusion to fall.^{98, 99} This hypothesis was challenged by Jia *et al.* in the September issue.¹⁰⁰ The authors evaluated 1982 patients who underwent noncardiac surgery to determine if low VT (6 mL/kg) would reduce AKI incidence in comparison to "conventional" VT (10 mL/kg). Results did not confirm the hypothesis since postoperative AKI occurred in 12 patients (1.3%) in the low VT group and 11 patients (1.1%) in the others.

Postoperative shivering is a very uncomfortable side effect of general or regional anesthesia, which affects patient liking negatively and can

increase oxygen consumption by up to 500%. Dinger *et al.* performed a network meta-analysis comparing 28 pharmacological interventions for treating postanesthetic shivering in adults and found that nefopam, tramadol, pethidine, and clonidine were the most effective.¹⁰¹ PONV is another unpleasant complication of anesthesia and remains a matter of concern despite the availability of updated guidelines for treatment and risk assessment.¹⁰² Theodosopoulou *et al.* authored a review published in June on gene polymorphisms that influenced the efficacy of 5-hydroxytryptamine (serotonin) type 3 receptor antagonists (5HT3RA) on PONV.¹⁰³ The ultrarapid metabolizer genotype was indeed associated with a reduced efficacy of ondansetron, dolasetron, and tropisetron, but not granisetron. Thus, a failure in managing PONV could be related to specific genetic profiles, and patients could benefit from a drug switch.

The World Health Organization recommends high inspiratory oxygen concentrations during surgery and for successive two-six hours to prevent surgical site infection. However, the real benefits of that indication are still debated.¹⁰⁴ Sadurni *et al.* randomized 403 adult patients scheduled for elective major colorectal surgery to receive an FIO₂ equal or higher than 0.8 or equal or lower than 0.4.¹⁰⁵ The study, published in June, failed to point out any difference between the two groups regarding the incidence of surgical site infections and cardiovascular events. Also, in the June issue, Alftian *et al.* reported that, in 84 adult patients undergoing major abdominal surgery, the diffusion capacity of expired CO₂ at rest and its dynamic assessment might accurately predict perioperative morbidity and mortality.¹⁰⁶ The two parameters are measured in the earlier phases of the cardiopulmonary exercise test, and the authors hypothesized that focusing on them might simplify and shorten the test.

Growing evidence supports the ERAS (Enhanced Recovery After Surgery) concept and has led to several regularly updated guidelines.¹⁰⁷ In the October issue, Mendez *et al.* reviewed 15 of them and found that only a few addressed blood management; the authors concluded by hoping that future ERAS guidelines will include some recommendations on that important topic.¹⁰⁸

Recently, some studies investigated the impact of intraoperative intravenous DEX and lidocaine on ERAS strategies.^{109, 110} MA published two articles on this topic. Qin *et al.* studied 96 elderly patients who underwent elective laparoscopic colorectal resection and found that the intraoperative infusion of lidocaine but not of DEX significantly reduced the time to bowel function recovery.¹¹¹ Xu *et al.* randomized 160 patients who underwent laparoscopic hysterectomy to receive an infusion of saline, DEX, lidocaine, or both drugs.¹¹² Patients who received DEX and lidocaine showed the best postoperative analgesia, sleep quality, and the most minor PONV incidence. However, they had the highest incidence of intraoperative bradycardia and postoperative hypoxia, as well as the most extended stay in the PACU.

One ERAS target is to decrease or abolish perioperative opioids. The July-August issue included a study by Bugada *et al.*, who evaluated the effects on opioid consumption of a prolonged wound infusion of ropivacaine (seven days) and methylprednisolone (first 24 hours) after major abdominal surgery.¹¹³ Compared with controls, the patients who received wound infusions beyond 48 hours had no benefit, except from decreased dosages of non-opioid analgesics. The authors concluded that prolonged wound infiltration did not confer sufficient clinical benefit to make change worthwhile, considering the risk of catheter-related complications, infections, and the cost.¹¹⁴

Alternative ERAS protocols may include novel strategies such as low-intensity transcutaneous auricular Vagus nerve stimulation. Such stimulation has been successfully applied to treating major depressive disorders and may positively affect the immune system.¹¹⁵ As a relative increase in inflammatory mediators occurs perioperatively, Ru *et al.* randomized 134 patients undergoing laparoscopic radical resection of colorectal cancer to receive low-intensity transcutaneous electrical stimulation of the Vagus right auricular branch for 20 minutes prior to anesthesia.¹¹⁶ Compared with controls, the experimental group developed postoperative ileus less frequently.

Postpartum hemorrhage is still a significant challenge in obstetric anesthesia, and placenta

previa is one of its significant factors of risk.¹¹⁷ In a study published in November, Xu *et al.* retrospectively analyzed 223 placenta previa patients undergoing cesarean delivery and designed an artificial neural network model to predict postpartum hemorrhage (PPH).¹¹⁸

Vega Colòn *et al.* compared intermediate-deep cervical blockade vs. general anesthesia in 100 patients undergoing carotid endarterectomy.¹¹⁹ They observed that the loco-regional technique was associated with better postoperative analgesia and shortened in-hospital length of stay. The study, published in the July-August issue, adds to a growing body of evidence supporting the use of loco-regional anesthesia in carotid endarterectomy.^{120, 121}

Finally, postoperative cognitive dysfunction remains a significant complication of anesthesia, both in children and adults.¹²² In March, Yang *et al.* reported the results of a meta-analysis on the effects of DEX on cognitive function after bowel surgery.¹²³ The authors concluded that DEX may enhance postoperative cognitive recovery.

Pain

Primary and secondary forms of myofascial pain syndrome (MPS) are common, affecting a large part of the population.¹²⁴ They can be localized or involve several muscles all over the body, and their management is still challenging.¹²⁵ In April, Guven Kose *et al.* reported the results of an excellent randomized clinical trial in which they demonstrated that both ultrasound-guided rhomboid intercostal block and ESPB could provide good long-lasting pain relief (at least six weeks) from unilateral MPS.¹²⁶

If poorly controlled, thoracic pain caused by trauma or surgery can negatively affect patients' long-term outcomes.¹²⁷ Effective analgesic treatments should be based on a deep knowledge of the complex pathophysiology. Feray *et al.* addressed this exciting topic in a pleasant narrative review published in November.¹²⁸ Other articles dealt with thoracic pain and its treatment. In November, a meta-analysis by Capuano *et al.* included ten randomized clinical trials with more than 600 patients. It showed that ESPB and paravertebral block provide equal degrees of analge-

sia and safety after thoracic surgery, even though the latter is more effective in reducing opioid consumption.¹²⁹

In the December issue, a study by Wu *et al.* investigated if regional anesthesia might be used as a rescue technique for systemic analgesia, contrary to what generally happens.¹³⁰ In 80 patients who underwent video-assisted thoracic surgery under general anesthesia combined with an ESPB, the serratus anterior plane block provided pain control and improved oxygenation better than IV fentanyl.

New evidence on the role of immune response in the genesis of chronic postoperative pain strongly supports the statement that pain should always be treated according to its pathophysiology.^{131, 132} This approach is essential in sports medicine, where there is a growing interest in treating pain as early as possible and reducing the risk of drug side effects. In this regard, regenerative medicine and peripheral neuromodulation may help treat pain without negatively affecting the athletes' performance. Fanelli *et al.* discussed this topic in the May issue.¹³³

Finally, chronic pain syndromes are frequently observed in long-Covid and can significantly affect patients' quality of life and working ability. The differential diagnosis between neuropathic and musculoskeletal pain is essential for the treatment.¹³⁴ The reader may find an extensive review of the clinical features and therapeutic options of the latter in the December issue of MA.¹³⁵

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Conflicts of interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Authors' contributions

All authors read and approved the final version of the manuscript.

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