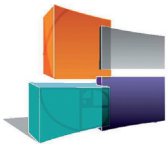
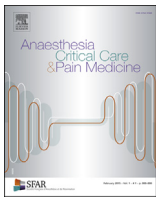
Anaesth Crit Care Pain Med 38 (2019) 405–411



SFAR
Société Française d'Anesthésie et de Réanimation



Guidelines

Revision of expert panel's guidelines on postoperative pain management

Frédéric Aubrun [a,*], Karine Nouette-Gaulain [b], Dominique Fletcher [c], Anissa Belbachir [d], Hélène Beloeil [e], Michel Carles [f], Philippe Cuvillon [g], Christophe Dadure [h], Gilles Lebuffe [i], Emmanuel Marret [j], Valeria Martinez [c], Michel Olivier [k], Nada Sabourdin [l], Paul Zetlaoui [m]

[a] *Hospices Civils de Lyon, 69317 Lyon, France*
[b] *CHU de Bordeaux, 33000 Bordeaux, France*
[c] *Hôpital Raymond-Poincaré, 92380 Garches, France*
[d] *Hôpital Cochin, 75014 Paris, France*
[e] *CHU de Rennes, 35000 Rennes, France*
[f] *CHU de Nice, 06001 Nice, France*
[g] *CHU de Nîmes, 30900 Nîmes, France*
[h] *CHU de Montpellier, 34000 Montpellier, France*
[i] *CHRU de Lille, 59000 Lille, France*
[j] *Institut hospitalier franco-britannique, 92300 Levallois-Perret, France*
[k] *CHU de Toulouse, 31059 Toulouse, France*
[l] *Hôpital Armand-Trousseau, 75012 Paris, France*
[m] *CHU de Kremlin Bicêtre, 94270 Le Kremlin Bicêtre, France*

ARTICLE INFO

Article history:
Available online 26 February 2019

Keywords:
Postoperative pain
Update of experts' guidelines

ABSTRACT

The French Society of Anaesthesia and Intensive Care Medicine (SFAR) published experts' guidelines on the care of postoperative pain. This was an update of the 2008 guidelines. Fourteen experts analysed the literature (PubMed™, Cochrane™) on questions that had not been treated in the previous guidelines, or to modify the guidelines following new data in the published literature. The used method is invariably the GRADE© method, which guarantees a rigorous work. Seventeen recommendations were formalised on the assessment of perioperative pain, and most particularly in non-communicating patients, on opioid and non-opioid analgesics and on anti-hyperalgesic drugs, such as ketamine and gabapentinoids, as well as on local and regional anaesthesia. The concept of vulnerability and therefore the identification of the most fragile patients in terms of analgesics requirements were specified. Because of the absence of sufficient data or new information, no recommendation was made about analgesia monitoring, the procedures for the surveillance of patients in conventional care structures, or perinervous or epidural catheterism.

1. SFAR Organisers and experts coordinators

Frédéric Aubrun, Karine Nouette-Gaulain

2. Organisational Committee

Dominique Fletcher, Hôpital Raymond Poincaré, Assistance Publique-Hôpitaux de Paris.

3. SFAR experts group

Frédéric Aubrun, Anissa Belbachir, Hélène Beloeil, Michel Carles, Philippe Cuvillon, Christophe Dadure, Dominique Fletcher, Gilles Lebuffe, Emmanuel Marret, Valeria Martinez, Karine Nouette Gaulain, Michel Olivier, Nada Sabourdin, Paul Zetlaoui.

4. Reading group

SFAR Guidelines committee: Julien Amour, Sylvain Ausset, Gérald Chanques, Vincent Compère, Philippe Cuvillion, Fabien Espitalier, Dominique Fletcher, Marc Garnier, Etienne Gayat, Jean-Marc Malinovski, Bertrand Rozec, Benoît Tavernier, Lionel Velly.

* Corresponding author at: Anesthésie réanimation douleur, hospices civils de Lyon, université Lyon 1, groupement hospitalier Nord, hôpital Croix- Rousse, 103, grande rue de la Croix-Rousse 69317 Lyon cedex 04. France.
E-mail address: frederic.aubrun@chu-lyon.fr (F. Aubrun).

https://doi.org/10.1016/j.accpm.2019.02.011

5. Introduction

Since the consensus conference on postoperative pain (POP) in 1997 and the experts' guidelines of 2008, it was necessary to complete or modify the existing guidelines. A group of 14 experts has worked on questions that have not been treated in the previous guidelines, or on published guidelines to be modified following new data in the literature. The method used remains the GRADE method, which guarantees a rigorous work.

Methodology

The method used to elaborate these guidelines was the GRADE® method. Following a quantitative literature analysis, this method was used to separately determine the quality of available evidence, *i.e.* estimation of the confidence needed to analyse the effect of the quantitative intervention, and the level of recommendation. The quality of evidence was rated as follows:

- high-quality evidence: further research is very unlikely to change the confidence in the estimate of the effect;
- moderate-quality evidence: further research is likely to have an impact on the confidence in the estimate of the effect and may change the estimate of the effect itself;
- low-quality evidence: further research is very likely to have an impact on the confidence in the estimate of the effect and is likely to change the estimate of the effect itself;
- very low-quality evidence: any estimate of the effect is very unlikely.

The analysis of the evidence's quality is performed for each study. A global level of evidence is then defined for a given question and criterion. The final wording of the recommendations will always be binary – either positive or negative, either weak or strong:

- strong recommendation: we recommend or we do not recommend (GRADE 1+ or 1−);
- weak recommendation: we suggest or we do not suggest (GRADE 2+ or 2−).

The strength of the recommendation is determined by key factors, and approved by the experts after a vote, using the Delphi and GRADE grids:

- estimate of the effect;
- global level of evidence: the higher this level, the stronger the recommendation;
- the balance between desirable and adverse effects: the more favourable the balance, the higher the recommendation;
- values and preferences: in the event of uncertainties or great variability, the recommendation will most likely be weak. These values and preferences must be obtained directly from the people involved (patient, doctor, decision-maker);
- costs: the higher the costs or the use of resources, the weaker the recommendation;
- to develop a recommendation, at least 50% of participants must have an opinion and less than 20% the opposite opinion;
- to develop a strong recommendation, at least 70% of participants must agree (grade between 7 and 10).

For some questions, the existence of several studies and/or meta-analyses of acceptable methodological quality, the GRADE method applied entirely and allowed making recommendations.

If experts did not have a meta-analysis allowing them to respond to the question, a quantitative analysis following the GRADE method was possible, and a systematic review was performed. An expert opinion was then proposed and approved if at least 70% of experts agreed with the proposal.

Finally, in some fields, the lack of recent studies did not allow us to formulate recommendations.

The questions tackled in these Guidelines updates are the following:

- postoperative pain (POP) assessment in adults and children:
  - when and why to assess it? Benefits of the assessment on postoperative consequences and chronicisation;
  - should the DN4 form be used in perioperative?
  - which pain scale(s) to use in children under 7 years old?
  - which scale(s) to use in non-communicating patients?
  - the procedures for the surveillance of patients in morphine-type medicine in postoperative, monitoring postoperative analgesia;
- analgesia monitoring: what are the methods enabling a monitoring of analgesia in the immediate postoperative period in children and adults?
- drug therapies via systemic and oral routes:
  - what is the place for selective and non-selective NSAIDs in perioperative?
  - what place for oxycodone in perioperative: main indications? What limits?
  - what are the indications on lidocaine in perioperative? What dose?
  - what place for corticoids in premedication, during and after surgery?
  - should small doses of ketamine be administered to all patients during surgery? what dose? When to administer it (before the incision or before the induction)? should ketamine be used in postoperative and if yes, in which patients?
  - what place for gabapentinoids in pre and postoperative?
- postoperative local and loco-regional anaesthesia:
  - what are the indications and limits for postoperative perinervous catheterisation?
  - what are the indications and limits for an epidural and paravertebral catheterisation?
  - what are the indications and limits for an infiltration catheterisation?

After the synthesis of our experts' work and the implementation of the GRADE method, 17 recommendations were formalised by the organisational committee. Among these, 11 are strong, 3 are weak and for 3 recommendations, the GRADE method could not be applied, and they are therefore formulated as experts' opinions.

The entirety of these recommendations was submitted to a proofreading group for a Delphi type rating. After two rounds of scoring and several amendments, a strong agreement was reached for 14 recommendations.

Pain assessment during the perioperative period

1. When and why to assess it? Benefits of the assessment on postoperative consequences and chronicisation,

2. Should the DN4 form be used perioperatively?

R1.1 – During the preoperative period, we recommend identifying the most vulnerable patients to pain (with risks to develop severe postoperative pain and/or a chronic post-surgical pain (CPSP)) by focusing on preoperative pain, including pain even far from the operating site, the long-term consumption of opioids, and surgical and psychological factors such as anxiety or depression.
Experts' opinion, Strong agreement

Argument: identifying patients implies a cautious supervision with a multimodal therapeutic strategy, including, whenever possible, regional analgesia and the administration of anti-hyper analgesic drugs.

Surgical factors are:

- surgical procedures such as thoracotomy [1], breasts surgery, sternotomy and iliac crest sampling [2,3], most likely to cause CPSP;
- repeated surgical procedures causing a risk of CPSP higher than the initial surgery [4], because of the high number of nerve damages on a revised scar tissue, more inflammatory tissues;
- surgical procedures with preoperative pain on the site of the intervention
- a duration of surgery greater than 3 hours.

R1.2 – We recommend using the APAIS scale (Amsterdam Preoperative Anxiety and Information Scale) as a measure anxiety and/or the need for information during the preoperative period.
Experts' opinion, Strong agreement

Argument: anxiety, stress and depression are the psychological factors most likely to cause severe postoperative pain [5–7]. They play an important role for CPSP development. Catastrophism is a predictive factor of a more intense postoperative pain, of greater morphine consumption in various surgical models, but also of a more frequent CPSP in orthopaedic surgery. The assessment during the pre-anaesthesia evaluation, using a simple scale (APAIS) would allow predicting the transition from acute to chronic POP.

R2. – We recommend identifying the postoperative risk factors for CPSP by searching a high intensity of POP (using a numerical scale), an uncommon prolongation of POP, an early neuropathic pain (using a DN4 scale), or signs of anxiety or depression.
Experts' opinion, Strong agreement

Argument: An early neuropathic pain should be properly treated [3]. The result of a positive screening of neuropathic pain should be reported to the patient, the surgeon and the referring physician.

3. Which pain scale(s) to use in children under 7 years old?

R3. – We recommend using a self-assessment scale from 5 years old (face scale, Appendix 1). Otherwise, we recommend using the FLACC scale for postoperative pain assessment in children under 7 years of age (Appendix 2).
G1+, Strong agreement

Argument: for new-borns: the EDIN (neonatal pain and discomfort scale), DAN (acute neonatal pain) and NFCS (neonatal facial coding system) scales can be used but have not been validated for postoperative pain. The FLACC (face legs activity cry consolability) scale can be used from 2 months old [8–10]. EVENDOL is a pain scale approved for an outside hospital use and Emergency unit only [11]. As for the EVA pain scale, it must be presented vertically to the child.

4. Which scale(s) to use in non-communicating patients?

R4. – For communicant patients, we recommend using a modified FLACC scale in children, and ALGOPLUS in elderly people.

G1+, Weak agreement

Argument: The modified FLACC scale can be used in non-communicant patient from birth until 18 years old and contains 5 simple behavioural items: face, legs, activity, screams and consolability [12,13]. For the ALGOPLUS scale [14], a grade $\geq$ 2/5 allows the diagnosis of pain with an 87% sensibility and a 80% specificity.

5. What are the procedures for monitoring the patients under opioid-like drugs in postoperative period?

The procedures for monitoring the patients under opioid-like drugs by subcutaneous route, by patient-controlled analgesia (PCA) or by epidural route were specified in the consensus conferences on postoperative pain management in adults and children of 1997 and 1999. These do not need to be changed.

No recommendation

Argument: since these last two recommendations, high-risk patients for respiratory depression-related to opioids were identified [15–18]. The literature highlights risks: patient over 70 years old, first-time on opiates, morbid obesity (BMI $>$ 35), respiratory disease, obstructive sleep apnoea (OSA), patient with liver or kidney failure, or describing an intense pain suddenly stopping, the association of opiates and drugs that can cause a depression of the central nervous system such as benzodiazepines, barbiturates, antidepressants, antiemetics or antihistaminic drugs. Likewise, the association of opiates with alcohol or illegal drugs, a history of neurological and/or neuromuscular disorders or the perimedullary route [19,20] require a reinforced monitoring, including a pulse oximetry.

A more frequent clinical and/or non-invasive monitoring (plethysmography, capnography in the post-anaesthesia care unit) are probably suggested for high-risk patients, and more specifically in case of OSA and for strong doses of opiates/sedatives consumed in perioperative period.

Apart from these various reminders, no new data enables to write more precise recommendations.

Analgesia monitoring: what are the methods enabling a monitoring of analgesia in the immediate postoperative period in children and adults?

No recommendation

Argument: the analysis of literature established that pupillometry, the ANI (Analgesia Nociception Index) and the SPI (Surgical Pleth Index) allow the correct assessment of the analgesia – nociception balance under general anaesthesia [21–23]. However, it is at the moment impossible to assert that such perioperative monitoring enables a decrease in postoperative pain or in the consumption of postoperative analgesics.

In awake patients, some publications suggest a degree of correlation between the ANI or the pupillometry and the pain scores obtained from the self or hetero-assessment scales [24,25]. However, the use of these monitors in the immediate

postoperative period did not prove to be better or more beneficial than auto or hetero-assessment scales.

It is however important to note that no study was performed in postoperative non-communicant patients, population for which pain assessment scales are most difficult.

Apart from these various reminders, no new data enables to write more precise recommendations

9. Drug therapies via systemic and oral routes

6. What is the place for selective and non-selective NSAIDs in perioperative?

R6.1. – We recommend the association of a non-selective NSAID (NS-NSAID) or a selective inhibitor of type 2 cyclooxygenase (ISCOX2) with morphine if there is no contraindication to the use of NSAIDs.
G1+, Strong agreement

Argument: NS-NSAIDs or ISCOX2, associated with morphine, allow an improvement of pain scores, a significant morphine sparing coupled with a decrease of sedation, PONVs and of the length of postoperative ileus. This association allows the most important decrease in morphine consumption when compare with other associations involving other non-opioid analgesics (nefopam or paracetamol). The level of evidence is high and based on an abundant literature of high methodological quality. Fifteen studies, amongst which 2 meta-analyses, have studied the benefit of NS-NSAIDs associated with morphine, and 25 studies, amongst which 1 meta-analysis, have studied the benefit of ISCOX2 associated with morphine. NS-NSAIDs and ISCOX2 were compared in 6 studies: 4 RCTs and 2 meta-analyses. Results showed similar benefits in terms of analgesia for both drugs either used alone or associated with morphine.

NSAIDs are probably recommended after colorectal surgery but a doubt remains on the risk of anastomotic leakage (Guidelines on enhanced recovery after colorectal surgery)

About the renal risk, we do not recommend prescribing a NSAID (NS or ISCOX2) in the event of renal hypoperfusion. An estimated clearance of plasma creatinine below 50 mL/min is a contraindication to NSAID [26,27].

R6.2. – We do not recommend using a type-2 inhibitor of cyclooxygenases (ISCOX2) in patients with a history of atherothrombosis (PAD (peripheral artery disease), stroke, myocardial infarction).
G1-, Strong agreement
R6.3 – We do not recommend administering NS-NSAIDs in patients atherothrombosis (PAD (peripheral artery disease), stroke, myocardial infarction) for more than 7 days
G2-, Strong agreement

Argument: The increased risk of atherothrombotic events associated with a chronic treatment (mainly after 7 days of treatment), with NS-NSAIDs or ISCOX2 is highly documented [28,29,30,31] in the medical literature. In the perioperative period, the atherothrombotic risk associated with ISCOX2 is well documented [32,33]. For NS-NSAIDs, the only two available studies are retrospective but have included a large number of patients (10 873 and 1 309); they did not report an additional cardiovascular risk [34,35].

R6.4 – We do not recommend associating NS-NSAIDs with curative doses of anticoagulant.
G1-, Weak agreement

Argument: the NSAIDs used in France (ketoprofen, ibuprofen) in the perioperative period do not increase the risk of postoperative haemorrhage, including after tonsillectomy [36,37]. No study assessing postoperative bleeding as the main outcome has been published so far [38–40]. The studies that have highlighted a haemorrhagc risk are either retrospective (n = 1) [41] or a meta-analysis [42] that has included the retrospective studies with an important heterogeneity. All of them studied ketorolac, which is not available in France. According to Bellis et al.'s meta-analysis published in 2014 [43] and including 15 studies and 1693 patient, NSAIDs administered with dexamethasone are not associated with an increased risk of haemorrhage. However, the association of NSAIDs and a curative dose of anticoagulants (enoxaparine, rivaroxaban or VKA) was shown to multiply by 2.5 the risk of severe [44].

7. What place for oxycodone in perioperative: main indications? What limits?

R7. – We recommend to prescribe a strong opiate (morphine or oxycodone), ideally through oral route, for severe postoperative pain or if weaker analgesics are not powerful enough to relief the patients. This recommendation applies to all ages.
G1+, Strong agreement

Argument: morphine remains the reference strong opiate in postoperative period. The oral route must be favoured as much as possible [45,46]. The clinical efficacy of oxycodone equals that of morphine, with a ratio of 1/1 for the IV route and ½ for the oral route (5 mg of oxycodone = 10 mg of morphine sulphate).

8. What are the indications on lidocaine in perioperative? What dose?

R8. – We suggest that adults who undergo major surgery (abdominal, pelvic or spinal surgeries) and who do not benefit regional analgesia receive intravenous lidocaine infusion (bolus: 1 to 2 mg/kg followed by 1 to 2 mg/kg/h) in order to decrease the level of postoperative pain and to improve recovery.
G2+, Strong agreement

Argument: lidocaine is a local anaesthetic usually administered for nerve or epidural block. Intravenous lidocaine presents analgesic, anti-hyperalgesic and anti-inflammatory properties. Comparisons between intravenous lidocaine and loco regional analgesia techniques will allow clarifying the role for each of these techniques. the panel proposed a bolus dose of IV lidocaine 1-2 mg.kg-1 followed by a continuous infusion of 1 to 2 mg/kg-1/h-1 [47–50].

9. What place for corticoids in premedication, during and after surgery?

R9. – We suggest that adults receive dexamethasone IV at 8 mg to reduce postoperative pain.
G2+, Strong agreement

Argument: corticosteroids are widely used in anaesthetised patients. Dexamethasone, given at induction of anaesthesia, is the most studied glucosteroid in anaesthesia and decreases the risk of postoperative nausea and vomiting Its effect on postoperative pain was assessed in numerous studies [51,52]. The recommended dose of dexamethasone is 8 mg in adults and 0.15 mg/kg in children.

10. Should small doses of ketamine be administered to all patients during surgery? What dose? When to administer it (before the incision or before the induction)? Should ketamine be used in postoperative and if yes, in which patients?

R10. – Intraoperatively, small doses of ketamine in patients on general anaesthesia are recommended in the two following situations: 1/ surgery with high risk of acute pain or chronic postoperative pain; 2/ patients with vulnerability to pain, and most particularly patients taking long-term opioids or addicted to opioids.
G1+, Strong agreement

Argument: ketamine is the anti-hyperalgesic drug recommended in first intention at a maximum dose of 0.5 mg/kg/h after anaesthesia induction (to prevent psychodysleptic side effects) more or less in continuous at a dose between 0.125 and 0.25 mg/kg/h. Perfusion will be stopped 30 min before the end of the surgery.

The use of ketamine at small doses during the surgical period allows a decrease in acute pain intensity for 24 hours, a mean drop of 15 mg in 24 hours of morphine consumption and a decrease in the risk of nausea and vomiting (moderate evidence) [53,54]. The continuation of ketamine treatment in the postoperative period increases the risk of hallucinations and does not importantly increase the analgesic effect. The effect on chronic postoperative pain is an estimated decrease of 30% in the incidence of chronic pain three months after surgery (low level of evidence) [55,56]. We cannot specify if the prolongation of treatment for 24 hours can allow a decrease in the risk of postoperative chronic pain.

Use of magnesium is not currently recommended because of a too low level of evidence

11. What place for gabapentinoids in pre and postoperative.

R11. – The systematic use of gabapentinoids preoperatively is not recommended for postoperative pain management.
G1-, Weak agreement

Argument: The use of gabapentine or pregabaline in premedication allows decreasing the pain intensity during the first postoperative day. The consumption of morphine and the risk of nausea and vomiting. However, both drugs are responsible for an increased risk of sedation and dizziness, and visual impairment (pregabaline) [55–59]. There is no noticeable effect on the prevention of chronic postoperative pain (high level of evidence) [55,59,60]. If the benefit/risk balance is taken into account, gabapentinoids should not be used systematically, or in outpatient surgery. There is no evidence on the interest of coupling gabapentinoids to ketamine. The key anti-hyperalgesic is ketamine. Patients who seem to benefit more from gabapentinoids in the immediate postoperative period are patients who undergo heavy pro-nociceptive surgeries such as arthroplasties, spinal surgery and amputations (high level of evidence). Gabapentinoids can also bring an interesting preoperative sedation if this effect is desired.

Postoperative local and loco-regional anaesthesia

12. What are the indications and limits for postoperative perinervous catheterisation?

13. What are the indications and limits for an epidural and paravertebral catheterisation?

No recommendation

Argument: recent literature confirms the interest of a perinervous catheter when there is a risk of postoperative pain, moderate to severe, and most particularly in shoulder (interscalenic) or knee (femoral) prosthetic surgery [61,62]. In addition to prolonged analgesia efficiency, the benefits concern the sparing effect of opioids and the decrease in morphine adverse effects (postoperative nausea and vomiting), the improvement of sleep and the satisfaction of patients.

However, the literature cannot demonstrate the input of perinervous catheters on pain chronicisation.

The risk of catheter mobilisation (5 to 25%) potentially decreases the analgesic benefit. The femoral catheter, by motor block induced and prolonged, can foster falls, alter rehabilitation and early recovery after a knee prosthetic surgery. The interscalenic catheter induces a diaphragmatic paresis to take into account in the event of respiratory pathology.

Apart from these various reminders, no new data allows writing more precise recommendations.

14. What are the indication and limits for an infiltration catheterisation?

R14.1 – It is recommended not to exceed the maximal toxic doses of local anaesthetics, most specifically for peri-prosthetic orthopaedic infiltrations and during associations of scar infiltrations and perinervous analgesic catheters.
G1+, Accord fort

Argument: For information, the maximum doses for the first injection of local anaesthetics in a young adult of class ASA 1 are reminded in the table hereunder:

Agent	Maximal dose in mg/kg
Lidocaine with adrenaline	7
Mepivacaine	5
Levobupivacaine	3
Ropivacaine	3

R14.2 –In case of laparotomy (laparotomy, caesarean section and lumbotomy), and in the absence of epidural analgesia, we probably recommend the implementation of a continuous infiltration catheter.
G2+, Strong agreement

Argument: Numerous infiltration protocols of the surgical site are recommended as an analgesic alternative to peripheral nervous catheters but their efficiency is less important in terms of analgesia after the 24th hour [63–65].

R14.3 – We do not recommend performing an analgesic infiltration using an intra-articular catheter because of the toxic risk of local anaesthetics on cartilage.
G1-, Strong agreement

Argument: published studies suggest a direct toxicity of local anaesthetics on chondrocytes [66,67].

Disclosure of interest

Aubrun: SANOFI, MYLAN, BAXTER.
Fletcher: PIERRE FABRE, BIOCODEX, GRUNENTHAL, MYLAN.
Beloeil: BBRAUN, ASPEN, ORION.
Cuvillon: GRUNENTHAL, MSD.
Lebuffe: MSD, BAXTER.
Martinez: GRUNENTHAL, MUNDIPHARMA, PFIZER, ASTELLAS.
The other authors declare that they have no competing interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at https://doi.org/10.1016/j.accpm.2019.02.011

References

[1] Duale C, Guastella V, Morand D, Cardot JM, Aublet-Cuvelier B, Mulliez A, et al. Characteristics of the neuropathy induced by thoracotomy: a 4-month follow - up study w ith psychophysical examination. Clin J Pain 2011;27:471–80.

[2] Dimitriou R, Mataliotakis GI, Angoules AG, Kanakaris NK, Giannoudis PV. Complications follow ing autologous bone graft harvesting fromthe iliac crest and using the RIA: a systematic review. Injury 2011;42(Suppl 2):S3–15.

[3] Martinez V, Ben Ammar S, Judet T, Bouhassira D, Chauvin M, Fletcher D. Risk factors predictive of chronic postsurgic al neuropathic pain: the value of the iliac crest bone harvest model. Pain 2012;153:1478–83.

[4] Gjeilo KH, Klepstad P, Wahba A, Lydersen S, Stenseth R. Chronic pain after cardiac surgery: a prospective study. Acta Anaesthesiol Scand 2010;54:70–8.

[5] Maurice-Szamburski A, Bruder N, Loundou A, Capdevila X, Auquier P. Development and validation of a perioperative satisfaction questionnaire in regional anesthesia. Anesthesiology 2013;118:78–87.

[6] Theunissen M, Peters ML, Bruce J, Gramke HF, Marcus MA. Preoperative anxiety and catastrophizing: a systematic review and meta-analysis of the association w ith chronic postsurgical pain. Clin J Pain 2012;28:819–41.

[7] Wattier JM, Barreau O, Devos P, Prevost S, Vallet B, Lebuffe G. [Measure of preoperative anx iety and need for information w ith six issues]. Ann Fr Anesth Reanim 2011;30:533–7.

[8] Bringuier S, Picot MC, Dadure C, Rochette A, Raux O, Boulhais M, et al. A prospective comparison of post- surgical behavioral pain scales in preschoolers highlighting the risk of false evaluations. Pain 2009;145:60–8.

[9] Crellin D, Sullivan TP, Babl FE, O'Sullivan R, Hutchinson A. Analysis of the validation of existing behavioral pain and distress scales for use in the procedural setting. Paediatr Anaesth 2007;17:720–33.

[10] von Baeyer CL, Spagrud LJ. Systematic review of observational (behavioral) measures of pain for children and adolescents aged 3 to 18 years. Pain 2007;127:140–50.

[11] Fournier-Charriere E, Tourniaire B, Carbajal R, Cimerman P, Lassauge F, Ricard C, et al. EVENDOL, a new behavioral pain scale for children ages 0 to 7 years in the emergency department: design and validation. Pain 2012;153:1573–82.

[12] Malviya S, Voepel-Lewis T, Burke C, Merkel S, Tait AR. The revised FLACC observational pain tool: improved reliability and validity for pain assessment in children w ith cognitive impairment. Paediatr Anaesth 2006;16:258–65.

[13] Voepel-Lewis T, Malviya S, Tait AR, Merkel S, Foster R, Krane EJ, Davis PJ. A comparison of the clinical utility of pain assessment tools for children w ith cognitive impairment. Anesth Analg 2008;106:72–8 [table of contents].

[14] Rat P, Jouve E, Pickering G, Donnarel L, Nguyen L, Michel M, et al. Validation of an acute pain-behavior scale for older persons w ith inability to communicate verbally: Algoplus. Eur J Pain 2011;15:198 [e1- e10].

[15] Ahmad S, Nagle A, McCarthy RJ, Fitzgerald PC, Sullivan JT, Prystowsky J. Postoperative hypoxemia in morbidly obese patients with and without obstructive sleep apnea undergoing laparoscopic bariatric surgery. Anesth Analg 2008;107:138–43.

[16] Gali B, Whalen FX, Schroeder DR, Gay PC, Plevak DJ. Identification of patients at risk for postoperative respiratory complications using a preoperative obstructive sleep apnea screening tool and postanesthesia care assessment. Anesthesiology 2009;110:869–77.

[17] Hw ang D, Shakir N, Limann B, Sison C, Kalra S, Shulman L, et al. Association of sleep- disordered breathing w ith postoperative complications. Chest 2008;133:1128–34.

[18] Weingarten TN, Herasevich V, McGlinch MC, Beatty NC, Christensen ED, Hannifan SK, et al. Predictors of delayed postoperative respiratory depression assessed from naloxone administration. Anesth Analg 2015;121:422–9.

[19] Kato R, Shimamoto H, Terui K, Yokota K, Miyao H. Delayed respiratory depression associated w ith 0.15 mg intrathec al morphine for cesarean section: a review of 1915 cases. J Anesth 2008;22:112–6.

[20] Siriussawakul A, Mandee S, Thonsontia J, Vitayaburananont P, Areewatana S, Laonarinthawoot J. Obesity, epidural analgesia, and subcostal incision are risk factors for postoperative desaturation. Can J Anaesth 2010;57:415–22.

[21] Boselli E, Bouvet L, Begou G, Dabouz R, Davidson J, Deloste JY, et al. Prediction of immediate postoperative pain using the analgesia/nociception index: a prospective observational study. Br J Anaesth 2014;112:715–21.

[22] Gruenew ald M, Ilies C, Herz J, Schoenherr T, Fudickar A, Hocker J, et al. Influence of nociceptive stimulation on analgesia nociception index (ANI) during propofol-remifentanil anaesthesia. Br J Anaesth 2013;110:1024–30.

[23] Sabourdin N, Arnaout M, Louvet N, Guye ML, Piana F, Constant I. Pain monitoring in anesthetized children: first assessment of skin conductance and analgesia-nociception index at different infusion rates of remifentanil. Paediatr Anaesth 2013;23:149–55.

[24] Boselli E, Daniela-Ionescu M, Begou G, Bouvet L, Dabouz R, Magnin C, et al. Prospective observational study of the non-invasive assessment of immediate postoperative pain using the analgesia/nociception index (ANI). Br J Anaesth 2013;111:453–9.

[25] Larson MD, Behrends M. Portable infrared pupillometry: a review. Anesth Analg 2015;120:1242–53.

[26] Acharya M, Dunning J. Does the use of non-steroidal anti-inflammatory drugs after cardiac surgery increase the risk of renal failure? Interact Cardiovasc Thorac Surg 2010;11:461–7.

[27] Elia N, Lysakowski C, Tramer MR. Does multimodal analgesia w ith acetaminophen, nonsteroidal antiinflammatory drugs, or selective cyclooxygenase-2 inhibitors and patient-controlled analgesia morphine offer advantages over morphine alone? Meta-analyses of randomized trials. Anesthesiology 2005;103:1296–304.

[28] Solomon SD, Mc Murray JJ, Pfeffer MA, Wittes J, Fowler R, Finn P, et al. Cardiovascular risk associated w ith celecoxib in a clinical trial for colorectal adenoma prevention. N Engl J Med 2005;352:1071–80.

[29] Graham DJ, Campen D, Hui R, Spence M, Cheetham C, Levy G, et al. Risk of acute myocardial infarction and sudden cardiac death in patients treated w ith cyclo-oxygenase 2 selective and non-selective non-steroidal anti inflammatory drugs: nested case-control study. Lancet 2005;365:475–81.

[30] Kearney PM, Baigent C, Godwin J, Halls H, Emberson JR, Patrono C. Do selective cyclo-oxygenase-2 inhibitors and traditional non-steroidal anti-inflammatory drugs increase the risk of atherothrombosis? Meta-analysis of randomised trials. BMJ 2006;332:1302–8.

[31] McGettigan P, Henry D. Cardiovascular risk and inhibition of cyc looxygenase: a systematic review of the observational studies of selective and nonselective inhibitors of cyclooxygenase 2. JAMA 2006;296:1633–44.

[32] Nussmeier NA, Whelton AA, Brown MT, Joshi GP, Langford RM, Singla NK, et al. Safety and efficacy of the cyclooxygenase-2 inhibitors parecoxib and valdecoxib after noncardiac surgery. Anesthesiology 2006;104:518–26.

[33] Schug SA, Joshi GP, Camu F, Pan S, Cheung R. Cardiovascular safety of the cyclooxygenase-2 selective inhibitors parecoxib and valdecoxib in the postoperative setting: an analysis of integrated data. Anesth Analg 2009;108:299–307.

[34] Oliveri L, Jerzewski K, Kulik A. Black box warning: is ketorolac safe for use after cardiac surgery? J Cardiothorac Vasc Anesth 2014;28:274–9.

[35] Liu SS, Bae JJ, Bieltz M, Ma Y, Memtsoudis S. Association of perioperative use of nonsteroidal anti-inflammatory drugs w ith postoperative myocardial infarction after total joint replacement. Reg Anesth Pain Med 2012;37:45–50.

[36] Moss JR, Watcha MF, Bendel LP, McCarthy DL, Witham SL, Glover CD. A multicenter, randomized, double -blind placebo-controlled, single dose trial of the safety and efficacy of intravenous ibuprofen for treatment of pain in pediatric patients undergoing tonsillectomy. Paediatr Anaesth 2014;24:483–9.

[37] Riggin L, Ramakrishna J, Sommer DD, Koren GA. 2013 updated systematic review & meta-analysis of 36 randomized controlled trials; no apparent effects of non steroidal anti-inflammatory agents on the risk of bleeding after tonsillectomy. Clin Otolaryngol 2013;38:115–29.

[38] Riggin L, Ramakrishna J, Sommer DD, Koren G. A 2013 updated systematic review & meta-analysis of 36 randomized controlled trials; no apparent effects of non steroidal anti-inflammatory agents on the risk of bleeding after tonsillectomy. Clin otolaryngol 2013;38:115–29.

[39] Lewis SR, Nicholson A, Cardwell ME, Siviter G, Smith AF. Nonsteroidal anti-inflammatory drugs and perioperative bleeding in paediatric tonsillectomy. Cochrane Database Syst Rev 2013;7:CD003591.

[40] Gobble RM, Hoang HL, Kachniarz B, Orgill DP. Ketorolac does not increase perioperative bleeding: a meta -analysis of randomized controlled trials. Plastic Reconstr Surg 2014;133:741–55.

[41] Caw thorn TR, Phelan R, Davidson JS, Turner KE. Retrospective analysis of perioperative ketorolac and postoperative bleeding in reduction mammoplasty. Can J Anaesth 2012;59:466–72.

[42] Chan DK, Parikh SR. Perioperative ketorolac increases post-tonsillectomy hemorrhage in adults but not children. The Laryngoscope 2014;124:1789–93.

[43] Bellis JR, Pir mohamed M, Nunn AJ, Loke YK, De S, Golder S, Kirkham JJ. Dexamethasone and haemorrhage risk in paediatric tonsillectomy: a systematic review and meta-analysis. Br J Anaesth 2014;113:23–42.

[44] Davidson BL, Verheijen S, Lensing AW, Gebel M, Brighton TA, Lyons RM, Rehm J, Prins MH. Bleeding risk of patients w ith acute venous thromboembolism taking nonsteroidal anti-inflammatory drugs or aspirin. JAMA Intern Med 2014;174:947–53.

[45] Richards P, Riff D, Kelen R, Stern W. A phase 3, randomized, double-blind comparison of analgesic efficacy and tolerability of Q8003 vs oxycodone or morphine for moderate-to-severe postoperative pain following bunionectomy surgery. Pain Med 2013;14:1230–8.

[46] Richards P, Riff D, Kelen R, Stern W, MoxDuo Study T. Analgesic and adverse effects of a fixed-ratio morphine- oxycodone combination (MoxDuo) in the treatment of postoperative pain. J Opioid Manag 2011;7:217–28.

[47] Marret E, Rolin M, Beaussier M, Bonnet F. Meta-analysis of intravenous lidocaine and postoperative recovery after abdominal surgery. Br J Surg 2008;95:1331–8.

[48] Sun Y, Li T, Wang N, Yun Y, Gan TJ. Perioperative systemic lidocaine for postoperative analgesia and recovery after abdominal surgery: a meta-analysis of randomized controlled trials. Dis Colon Rectum 2012;55:1183–94.

[49] Ventham NT, Kennedy ED, Brady RR, Paterson HM, Speake D, Foo I, et al. Efficacy of intravenous lidocaine for postoperative analgesia follow ing laparoscopic surgery: a meta-analysis. World J Surg 2015;39:2220–34.

[50] Vigneault L, Turgeon AF, Cote D, Lauzier F, Zarychanski R, Moore L, et al. Perioperative intravenous lidocaine infusion for postoperative pain control: a meta-analysis of randomized controlled trials. Can J Anaesth 2011;58:22–37.

[51] De Oliveira Jr , Almeida MD, Benzon HT, McCarthy RJ. Perioperative single dose systemic dexamethasone for postoperative pain: a meta-analysis of randomized controlled trials. Anesthesiology 2011;115:575–88.

[52] Waldron NH, Jones CA, Gan TJ, Allen TK, Habib AS. Impact of perioperative dexamethasone on postoperative analgesia and side-effects: systematic review and meta-analysis. Br J Anaesth 2013;110:191–200.

[53] Elia N, Tramer MR. Ketamine and postoperative pain–a quantitative systematic review of randomised trials. Pain 2005;113:61–70.

[54] Laskow ski K, Stirling A, McKay WP, Lim HJ. A systematic review of intravenous ketamine for postoperative analgesia. Can J Anaesth 2011;58:911–23.
[55] Chaparro LE, Smith SA, Moore RA, Wiffen PJ, Gilron I. Pharmacotherapy for the prevention of chronic pain after surgery in adults. Cochrane Database Syst Rev 2013;7:CD008307.
[56] McNicol ED, Schumann R, Haroutounian S. A systematic review and meta-analysis of ketamine for the prevention of persistent post-surgical pain. Acta Anaesthesiol Scand 2014;58:1199–213.
[57] Dahl JB, Mathiesen O, Moiniche S. 'Protective premedication': an option w ith gabapentin and related drugs? A review of gabapentin and pregabalin in in the treatment of post-operative pain. Acta Anaesthesiol Scand 2004;48:1130–6.
[58] Eipe N, Penning J, Yazdi F, Mallick R, Turner L, Ahmadzai N, Ansari MT. Perioperative use of pregabalin for acute pain - a systematic review and meta-analysis. Pain 2015;156:1284–300.
[59] Mishriky BM, Waldron NH, Habib AS. Impact of pregabalin on acute and persistent postoperative pain: a systematic review and meta-analysis. Br J Anaesth 2015;114:10–31.
[60] Clarke H, Bonin RP, Orser BA, Englesakis M, Wijeysundera DN, Katz J. The prevention of chronic postsurgical pain using gabapentin and pregabalin: a combined systematic review and meta-analysis. Anesth Analg 2012;115:428–42.
[61] Bingham AE, Fu R, Horn JL, Abrahams MS. Continuous peripheral nerve block compared w ith single-injection peripheral nerve block: a systematic review and meta-analysis of randomized controlled trials. Reg Anesth Pain Med 2012;37:583–94.
[62] Ullah H, Samad K, Khan FA. Continuous interscalene brachial plexus block versus parenteral analgesia for postoperative pain relief after major shoulder surgery. Cochrane Database Syst Rev 2014;2:CD007080.
[63] Andersen LO, Kehlet H. Analgesic efficacy of local infiltration analgesia in hip and knee arthroplasty: a systematic review. Br J Anaesth 2014;113:360–74.
[64] Dahl JB, Moiniche S. Relief of postoperative pain by local anaesthetic infiltration: efficacy for major abdo minal and orthopedic surgery. Pain 2009;143:7–11.
[65] Ventham NT, O'Neill S, Johns N, Brady RR, Fearon KC. Evaluation of novel local anesthetic w ound infiltration techniques for postoperative pain follow ing colorectal resection surgery: a meta-analysis. Dis Colon Rectum 2014;57:237–50.
[66] Cobo-Molinos J, Poncela-Garcia M, Marchal-Corrales JA, Delgado-Martinez AD. Effect of levobupivacaine on articular chondrocytes: an in-vitro investigation. Eur J Anaesthesiol 2014;31:635–9.
[67] Sherman SL, James C, Stoker AM, Cook CR, Khazai RS, Flood DL, Cook JL. In Vivo toxicity of local anesthetics and corticosteroids on chondrocyte and synoviocyte viability and metabolism. Cartilage 2015;6:106–12.