THE RECOMMENDATIONS FOR PERIOPERATIVE PAIN RELIEF IN GENERAL SURGERY

MAREK KRAWCZYK, JERZY WORDLICZEK, ANTONI CZUPRYNA, JAN DOBROGOWSKI, MAREK DOBOSZ, WOJCIECH GASZYNISKI, PIOTR ANDZIAK, HANNA MISIOŁEK, ADAM DZIKI

Post-operative pain is caused by intra-operative damage to the tissue/organs; its intensity and range are usually proportional to the extent of surgery. Post-operative pain occurs when intra-operative analgesia stops acting. It is caused by damaged superficial tissues (skin, subcutaneous tissue, mucous membranes), as well as deeper structures (muscles, fascias, ligaments, periosteum). If an injury is large, apart from superficial and deep somatic pain, also a visceral component of post-operative pain appears, resulting from the contraction of smooth muscles, caused by crushing or stretching of visceral structures along with inflammatory changes, pulling or twisting of the mesentery.

Post-operative pain is a „self-limiting phenomenon”. It is the most intense on the first and second day after surgery and much smaller on the third or fourth day. Pain is the most irritating in patients after thoracotomy and abdominal surgeries, while the procedures on integuments and limbs are much less painful. The following factors are crucial in patient’s perception of pain: the location of surgery, its extent, a degree of tissue trauma, a direction of skin cutting and perioperative analgesia techniques.

Pain relief is a fundamental right of the patient. We know that the proper treatment of postoperative pain (POP) significantly reduces perioperative morbidity, including the number of postoperative complications, the duration and costs of hospitalization, especially in patients at the high risk (ASA III-V), those undergoing extensive surgery and hospitalized at intensive care units. Therefore, relieving acute pain, including post-operative pain must be one of the priority institutional objectives and an integral part of treating a „perioperative disease” covering pain relief, early mobilization and enteral nutrition along with active physiotherapy).

In Poland, a team of experts appointed by the Association of Polish Surgeons, Polish Society for the Study of Pain, the Polish Society of Anaesthesiology and Intensive Care, has established the following criteria for proper organizing the system aimed to improve the quality of pain management in the postoperative period:

– the assessment of pain intensity in all operated patients, at least 4 times a day,
– informing patients before surgery, about the possible methods of postoperative pain management,
– recording the measurements of pain and the management in accordance with the recommendations of pain relief,
– monitoring possible side effects of the treatment on a special form designed to report adverse drug reactions.

Appropriate patient education is a crucial element of pain management in the perioperative period. It involves oral and written information on post-operative pain and its methods of treatment. This information should include the most important data on:

– methods of measuring the pain,
– methods of pain relief,
– the importance of post-operative pain relief for the therapeutic process.

Preoperative talk to the patient, his legal guardians or relatives should focus on:

– obtaining information on patient’s previous experiences with pain and preferences for analgesic treatment,
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– discussing with the patient the tools that will be used to measure pain intensity, teaching how to use them and determining the level of pain intensity when analgesic treatment will be implemented,
– informing the patient about possible methods of his/her future pain management,
– discussing with the patient his/her future pain management plan,
– explaining the patient the importance of giving true information on the experienced pain for the entire therapeutic process (avoiding stoicism and exaggerating pain intensity).

In case of severe postoperative pain, patients should receive strong painkiller, regardless of the type of surgery.

The evaluation and pain measurement

The measurement of pain intensity is one of the most important elements of an effective analgesic treatment. It should be assessed both at rest and in motion, every four to eight hours. The authors highly recommend the 11-point numerical scale NRS (Numerical Rating Scale) to be used in older children and adults – the evaluation of pain in the numerical scale from 0 to 10.

Assessing pain intensity using this scale we ask the patient to determine the intensity of current pain by pointing an appropriate number, where „0” denotes „no pain” and „10” „unimaginable pain”.

The route of analgesic administration

Also, the route of administering a painkiller is important. It should be noted that hypovolemia and hypothermia, that can occur in the postoperative or post-traumatic period, weaken the absorption of drugs given into the muscles and subcutaneous tissue. As a direct consequence analgesia is ineffective, despite the administration of a recommended dose. Therefore, in the postoperative period painkillers should be given intravenously, especially after major surgeries.

Continuous intravenous infusion of opioids

Analgesic treatment should aim to achieve the minimum effective analgesic concentration – MSSA in serum and its maintenance throughout the whole pain duration.

Continuous intravenous infusion of opioids (an automatic syringe or drip) enables to achieve the MSSA concentrations because a loading dose is determined by titration (I level of credibility according to EBM).

In titration, a small dose of an opioid such as morphine (1-2 mg) or oxycodone (1 mg) is slowly administered intravenously every 10 minutes until pain disappears or significantly weakens and then the drug concentration is maintained at the MSSA level by giving an opioid in continuous infusion. A dose maintaining the effective level of analgesia will correspond to a half of a loading dose for duration equivalent to half-life of an opioid. This allows a highly probable determination of continuous the intravenous infusion parameters, on the assumption that most of opioids have the half-life of approximately 3-4 hours. For example, in a patient taking a loading dose of 6 mg of morphine, 3 mg of morphine is eliminated during one half-life (6 mg/2). This means that in this patient an hourly demand for morphine is 1 mg (3 mg/3 hours) and this morphine dose should be given to the patient in continuous infusion in order to maintain the opioid MSSA).

However, it should be noted that in the postoperative or post-traumatic period, the patient may experience the so-called “breakthrough pain” associated with being subjected to painful procedures (a dressing change, repositioning of drains) or rehabilitation. Therefore, these procedures should be preceded by the intravenous administration of an additional dose of painkiller, for example 1-2 mg of morphine.

Opioids – key information:

– The use of opioids may cause adverse effects depending on dosage; vomiting can be reduced with dexamethasone and/or ondansetron.
– Morphine is the „gold standard” of painkillers, because it is a pure opioid agonist. It does not have a ceiling effect in analgesic efficacy, but its use is limited due to the typical side effect of opioids.
– Multimodal analgesia involves the use of various classes of analgesics. The use of
NSAIDs, metamizol or paracetamol in combination with opioids causes “the effect of reduced demand for opioids”; a 40% reduction in the amount of required morphine for the combination with NSAIDs and a 20% reduction in the combination with paracetamol during the first 24 hours after surgery.

- The combination of tramadol with paracetamol allowed reducing the dose of both substances and improved therapeutic efficacy (more effective in reducing pain) and tolerability (reducing side effects). A synergistic effect of the combination of tramadol and paracetamol was confirmed in clinical practice.
- tramadol causes less constipations and has a weaker inhibitory effect on the respiratory system than equianalgesic doses of morphine (1:5).
- Tramadol has a low abuse potential and is not classified as a „controlled drug”.

Non-opioid analgesics

Non-opioid analgesics are increasingly used in the treatment of postoperative pain. This became possible due to the synthesis of intravenous forms. An especially good analgesic effect can be achieved by combining an intravenous form of NSAIDs (non-steroidal anti-inflammatory drugs) with paracetamol or metamizol and an opioid also administered intravenously. Both NSAIDs and metamizol or paracetamol should be used after extensive surgery as drugs that adjuvant opioid therapy. The use of drugs from this group can reduce opioid doses by about 25-40% (I level of credibility according to EBM). This reduces the risk of adverse reactions associated with the use of opioids such as drowsiness, nausea, vomiting, dizziness (I level of credibility according to EBM). NSAIDs, metamizol and paracetamol are widely used in patients after surgery of the facial skull, orthopaedic procedures (including one day surgery) and post-traumatic pain relief, especially in outpatients.

In patients with low or moderate postoperative pain intensity, it is recommended to give every 6-12 hours intravenously (or orally):

- metamizol (1-2.5 g, maximum 5 g / day)
- or paracetamol (0.5-1 g, maximum 4 g / day)

In combination (or not) with one of the following NSAIDs:
- ketoprofen (50 mg) i.v. every 6 hours
- dexketoprofen (50 mg) i.v. every 8 hours
- diclofenac (50 mg) p.o., per rectum every 8 hours
- ibuprofen (400 mg) p.o., per rectum every 8 hours
- naproxen (250-500 mg) p.o. every 8 hours

In the case of inadequate analgesia, the combination of tramadol with paracetamol should be applied (1 tablet contains 37.5 mg + 325 mg; maximum 8 tablets / day, this corresponds to 300 mg of tramadol and 2600 mg of paracetamol).

Metamizole

Metamizole administered intravenously is effective in relieving moderate postoperative pain.

- Analgesic potency of a dose of 2.5 g is comparable to the dose of 10 mg of morphine (II level of credibility according to EBM). NNT index for a dose of 500 mg (i.v.) is 2.5 and 1.9 for a dose of 1000 mg (i.v.).
- Metamizole showing a synergistic effect of tramadol increases analgesic efficacy and the combined application of these two drugs will reduce the need for opioids by 35-40%.
- It should be noted that metamizole ought to be administered by a slow intravenous injection and a recommended single intravenous dose is 1-2.5 g (0.25-0.5 g/1-5 min.). In the case of continuous intravenous infusion, an initial drug dose is 2.5 g (slow infusion over 15 min.) and followed by continuous infusion of the drug in a dose of 100-150 mg/hour.
- The drug is available as oral/intravenous/intramuscular and rectal formulations. In rare cases, the parenteral administration may cause hypotension. The available data indicate that metamizole causes no gastric or renal adverse effects, as it is observed in the case of non-steroidal anti-inflammatory drugs.
- Cases of sudden blood pressure drops are probably often connected with the rapid
in intravenous administration as the risk of anaphylaxis in this case is low.

- The international study on agranulocytosis and aplastic anaemia has shown increased incidence after the administration of metamizole, 1 case per million. For example in Poland, there were no cases of agranulocytosis after the use of metamizole, despite total consumption of over 110 million tablets a year.

- The risk of agranulocytosis should be evaluated in the context of other analgesics and their associated risks. Meta-analysis conducted by Andrade et al. showed that the estimated additional mortality connected with severe adverse events was 185 per 100 million for aspirin, 592 per 100 million for diclofenac, but only 20 per 100 million for paracetamol and 25 per 100 million for metamizole.

**Paracetamol**

- It is the most popular and most widely used antipyretic and analgesic agent in the world having proven analgesic efficacy.

- Paracetamol showing a synergistic effect with tramadol increases analgesic efficacy and the combined use of these two drugs reduces the need for opioid by 35-40%.

- Longer gastric emptying after surgery limits the usefulness of oral paracetamol preparations as analgesics and the situation is even worse with the concomitant use of opioids. Similarly, in the case of a nasogastric tube.

- Parenteral paracetamol formulation significantly increases the usefulness of this drug as a perioperative analgesic as it allows administering it to the patients unable to take oral agents.

- Organ toxicity occurs primarily as a result of an overdose or chronic use. This rather does not happen in the postoperative period.

- Paracetamol metabolism occurs mainly in the liver; therefore, caution should be exercised in patients with an active liver disease, alcohol abuse and long-term depletion of glutathione stores.

- Haematological toxicity is extremely rare, paracetamol, however, can cause haemolysis in patients homozygous in G6PD deficiency (glucose-6-phosphate dehydrogenase).

- Drops in the cardiac index by 10% were observed in patients undergoing cardiac surgery.

- Paracetamol is an effective analgesic (NNT 3.5-3.8 per 500-1000 mg) having no significant adverse side effects.

- The combination of paracetamol and morphine allows reducing the required daily dose of opioid by 20-33%.

**Non-steroidal anti-inflammatory drugs – NSAIDs**

- The mechanism of action of these compounds is based on inhibiting prostaglandin synthesis.

- NSAIDs administered together with opioids reduce the need for opioids and the incidence of nausea, vomiting and sedation.

- NSAIDs combined with paracetamol increase an analgesic effect of paracetamol used alone (I level of credibility according to EBM).

- Provided that patients are properly selected, the incidence of perioperative renal impairment induced by NSAIDs is low (I level of credibility).

- The use of NSAIDs is associated with adverse cardiovascular events, in particular myocardial infarction; naproxen may cause a lower risk than other NSAIDs.

- The preoperative use of NSAIDs increases the risk of severe bleeding after many types of surgeries compared with placebo (I level of credibility).

- Proton pump blockers (e.g., omeprazole) reduce the risk of gastrointestinal bleeding.

**Regional anaesthesia in the treatment of postoperative pain**

Regional anaesthesia techniques, including surgical site infiltration analgesia, peripheral and central blockade can be successfully used in the treatment of acute post-traumatic or post-operative pain.

**Central blockades (epidural, spinal)**

- In operations where it can be used, epidural analgesia provides better postoperative
pain relief compared to the use of parenteral opioids and non-opioid painkillers.
- Local anaesthetics given epidurally improve oxygenation, reduce the incidence of infections and other pulmonary complications compared with parenteral opioids (I level of credibility).
- Epidural anaesthesia in the thoracic region has a positive effect on the gastrointestinal function (I level of credibility).
- Epidural anaesthesia is not associated with an increased risk of anastomotic leakage after bowel surgery (I level of credibility).
- Epidural anaesthesia in the thoracic region reduces the need for mechanical ventilation in patients with multiple rib fractures (I level of credibility) and the incidence of pneumonia (II level of credibility).
- The risk of permanent neurological damage associated with epidural anaesthesia is low. Immediate decompression (within 8 hours from the onset of neurological signs) increases a likelihood of partial or complete restoration of the function (IV level of credibility).
- Fat emulsion is effective in resuscitation of circulatory collapse caused by toxic effects of local anaesthetics. However, it should be used only after implementation of the standard advanced life support and controlling seizures.
- The perioperative use of epidural analgesia reduces the incidence of severe phantom pain.
- Clinical trials have shown that continuous peripheral nerve blockade is as effective as continuous epidural blockade after major orthopaedic surgeries of the upper and lower limbs. While, both these techniques are more effective than the intravenous administration of opioids.
- Regional analgesia should also be used in patients in a severe condition to reduce the number and doses of sedatives and opioids.
- Compared to opioid analgesia, continuous nerve blockade (regardless of the location of a catheter) gives more effective postoperative analgesia, reduces the need for opioids and limits nausea, vomiting and sedation (I level of credibility).
- The continuous administration of local anaesthetics into the wound reduces the pain at rest and in motion along with the need for opioids, postoperative nausea, vomiting and the hospitalization period. Patient’s satisfaction is greater and there is no increased rate of a wound infection (I level of credibility).
- Intraperitoneal administration of a local anaesthetic after laparoscopic cholecystectomy reduces the severity of early postoperative pain (I level of credibility).

**ANALGESIC TREATMENT DEPENDING ON THE EXTENT AND A DEGREE OF TISSUE INJURY:**

**NOTES**
Categorization of treatments based on pain intensity relates to elective procedures.

In emergency treatments accompanied by severe inflammation, ischemia, etc., pain category usually increases by 1 degree, for example laparotomy in acute pancreatitis belongs to category IV.

Bariatric treatment from the classic access belongs to the category of gastric and small intestine surgery.

I. Surgery with a small tissue injury

Surgical procedures having postoperative pain intensity < 4 points according to NRS or VAS, for example:
- excision of skin lesions,
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- excision of lesions located in the subcutaneous tissue and soft tissues,
- incision of soft tissue abscesses,
- excision of the regional lymph nodes (cervical, axillary, inguinal),
- operations of inguinal, femoral and umbilical hernia,
- the replacement of an expander with a prosthesis,
- local excision of the breast, excision of a breast quadrant, mastopexy, plastic reduction,
- varicose vein operations (classic and minimal invasive treatments).

Pharmacotherapy – before surgery

Consider for analgesia induction in advance:
- metamizol (1-2.5 g) intravenously,
- paracetamol (1 g 1-2 g intravenously or rectally),
- ketoprofen (50-100 mg) or dexketoprofen (25-50 mg) in intravenous infusion.

Pharmacotherapy – after surgery

- metamizol (1-2.5 g, maximum 5 g / day) every 6-12 hours intravenously or orally,
- or 1 g of paracetamol intravenously or orally every six hours in combination with NSAIDs in intravenous infusion or orally.

The combination of paracetamol and tramadol in drops should be used in the patient after surgery classified as category I with pain intensity 4 or more according to the NRS (the use of tramadol in drops will facilitate dose adjustment to the needs of the patient).

Later (on the first postoperative day), oral analgesics in fractionated doses may be used:
- metamizol – 500 mg,
- or paracetamol (0.5-1 g, maximum 4 g / day) combined (or not) with one of the following NSAIDs:
  - ketoprofen (50 mg) p.o. every 6-8 hours
  - dexketoprofen (25 mg) p.o. every 6-8 hours
  - diclofenac (50 mg) p.o. every 8 hours
  - ibuprofen (400 mg) p.o. every 8 hours
  - naproxen (250-500 mg) p.o. every 8 hours

If analgesia is inadequate, use the combination of tramadol and paracetamol or tramadol drops. In the case of using NSAIDs, we should remember of the need to apply a proton pump inhibitor (e.g. omeprazole 20 mg, and in patients with the increased risk of gastrointestinal bleeding, the dose should be increased to 40 mg).

Local analgesia

Before surgery (in order to induce analgesia in advance) inject into the predicted cut line:
- lidocaine 1%, 10-20 ml,
- or bupivacaine 0.25%, 5-10 ml
- or ropivacaine 0.5%, 5-10 ml

After the treatment, depending on its type:
- another injection into the wound;
- continuous infusion of a local anaesthetic through a catheter inserted into the wound (using an automatic syringe or an elastomeric pump);
- or intra-articular administration of a local anaesthetic – 5-10 ml of 0.25% bupivacaine and/or opioids: morphine 1-2 mg or fentanyl 20-25 μg.

A discharge summary should include the compact information for patient’s family doctor about the need to continue the use of analgesics applied at the department. At discharge, the patient should be given a prescription for painkillers.

II. Surgical procedures with a moderate tissue injury

Surgical procedures with postoperative pain intensity > 4 points according to NRS or VAS, but the duration of postoperative pain is usually shorter than 3 days, e.g.:
- thyroid surgery,
- Zenker diverticulum surgery,
- mastectomy (simple, modified radical),
- placing an expander under the pectoralis major muscle (the first stage of breast reconstruction),
- diagnostic or exploratory laparoscopy,
- appendectomy (classic, laparoscopic),
- laparoscopic cholecystectomy,
- surgery of hernias in postoperative scars and large abdominal hernias (the classic and laparoscopic access),
- laparoscopic surgery within the esophageal hiatus,
- bariatric laparoscopic procedures,
- tracheostomy,
– haemorrhoids anal fissure surgery,
– embolectomy,
– TEM treatments,
– amputation of the toes, feet, hands.

Pharmacotherapy – before surgery

Consider for analgesia induction in advance:
– metamizol (1-2.5 g) intravenously,
– paracetamol (1 g 1-2 g intravenously or rectally),
– ketoprofen (50-100 mg),
– dexketoprofen (25-50 mg) in intravenous infusion.

Pharmacotherapy – after surgery:

– metamizol (1-2.5 g, maximum 5 g / day) every 6-12 hours intravenously or orally,
– or paracetamol 0.5-1 g intravenously every 6 hours in combination (or not) with:
  – ketoprofen (50-100 mg) in intravenous infusion every 12 hours
  – or dexketoprofen (25 mg) intravenously every 8 hours
– or oral preparation of tramadol with paracetamol

Additionally, in case of pain and at patient’s request small doses of intravenous opioids should be given using the NCA method (the refractory period – 10 min.):
– tramadol (10-20 mg)
– or morphine (1-2 mg)
– or oxycodone (0.03 mg/kg of the body mass)
– or oral preparation of tramadol with paracetamol

On the 2-3 day after surgery, oral non-opioid analgesics in fractionated doses can be used, for example:
– metamizol – 500 mg,
– or also paracetamol (0.5-1 g, maximum 4 g / day) combined (or not) with one of the following NSAIDs:
  – ketoprofen (50 mg) p.o. every 6-8 hours
  – dexketoprofen (25 mg) p.o. every 6-8 hours
  – diclofenac (50 mg) p.o. every 8 hours
  – ibuprofen (400 mg) p.o. every 8 hours
  – naproxen (250-500 mg) p.o. every 8 hours
– or oral formulation of tramadol with paracetamol

In the case of using NSAIDs, we should remember of the need to use a proton pump inhibitor (e.g. omeprazole 20 mg, and in patients with the increased risk of gastrointestinal bleeding, the dose should be increased to 40 mg).

Local analgesia

1. Before surgery (in order to induce analgesia in advance) inject into the predicted cut line:
   – lidocaine 1%, 10-20 ml,
   – or bupivacaine 0.25% 5-10 ml
   – or ropivacaine 0.5% 5-10 ml
2. After surgery, depending on its type:
   – an injection of the wound edges with the solution of a local anaesthetic,
   – continuous infusion of a local anaesthetic through a catheter inserted into the wound,
   – peripheral nerve blockade,
   – plexus blockade,
   – paravertebral blockade,
   – intrapleural anaesthesia.

A discharge summary should include the compact information for patient’s family doctor about the need to continue the use of analgesics applied at the department. At discharge, the patient should be given a prescription for painkillers.

III. Surgical procedures with a significant tissue injury

Surgical procedures with postoperative pain intensity > 4 points according to the NRS or VAS, however, the duration of postoperative pain is usually longer than 3 days.
– exploratory laparotomy, the release of adhesions,
– gastric operations,
– small intestine operations,
– large intestine operations (classic and laparoscopic),
– pancreatic operations,
– liver operations,
– biliary operations (except for laparoscopic cholecystectomy),
– excision of the spleen, kidney, adrenal glands,
– breast reconstruction using peduncled lobes,
– fasciotomy,
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– amputation of the leg, thigh, arm.

If there are no contraindications, we should follow the rule of using standard multimodal analgesia.

Pharmacotherapy – before surgery:

Consider for analgesia induction in advance:
– metamizol (1-2.5 g) intravenously,
– paracetamol (1 g intravenously or 1.2 g rectally),

ketoprofen (50-100 mg) or dexketoprofen (25-50 mg) in intravenous infusion.

Pharmacotherapy – after surgery:

– continuous intravenous infusion of an opioid (e.g. morphine, oxycodone) – at the dose determined using „titration”
– or if suitable equipment is available, patient-controlled analgesia (PCA) with opioids can be used

Intravenous infusion or fractionation of opioids should be associated with the use of NSAIDs (I level of credibility according to EBM):
– metamizol (1-2.5 g, maximum 5 g / day) every 6-12 hours intravenously;
– or paracetamol 0.5-1 g intravenously every 6 hours in combination (or not) with:
  - ketoprofen (50-100 mg) in intravenous infusion every 12 hours
  - or dexketoprofen (25 mg) in intravenous infusion every 8 hours

In the case of using NSAIDs, we should remember of the need to use a proton pump inhibitor (e.g. omeprazole 20 mg, and in patients with the increased risk of gastrointestinal bleeding, the dose should be increased to 40 mg). We should remember of the need to alleviate the so-called “breakthrough pain” by giving additional doses of opioids:
– morphine 1-2 g i.v. may be repeated after 10-15 minutes;
– oxycodone 1-2 mg i.v. may be repeated after 15 minutes
– or oral formulation of tramadol with paracetamol

Local analgesia

In most cases, regional analgesia is a continuation of surgical anaesthesia. Continuous epidural analgesia with the use of local anaesthetics in combination with opioids is the most commonly recommended method as it can be applied in various fields of surgery and its efficacy is satisfactory. Given the persistence of pain, an epidural catheter should be maintained until the patient is fully mobilized. However, both total dose of opioids and the concentration of a local anaesthetic should be appropriately modified based on the assessment of pain intensity. Please note that continuous epidural analgesia is an effective method in 90% of patients in this group. After some surgeries, an alternative to epidural analgesia can be the following:
– continuous spinal anaesthesia,
– paravertebral blockade,
– intrapleural anaesthesia,
– plexus blockade.

A discharge summary should include the compact information for patient’s family doctor about the need to continue the use of analgesics applied at the department. At discharge, the patient should be given a prescription for painkillers.

IV. Surgical procedures with an extensive tissue injury

The operations on more than one body cavity and reconstructive procedures after major trauma. The expected level of postoperative pain intensity > 6 points according to the VAS or NRS and the duration of postoperative pain is longer than 7 days, e.g.:
– excision of the oesophagus by thoracolaparotomy,
– reconstruction operations in polytrauma with the opening of two body cavities.

The standard of analgesia does not differ substantially from the standard determined for patients after surgery with a significant tissue injury. If there are no contraindications, we should follow the standard rule of multimodal analgesia.

Pharmacotherapy – before surgery

Consider for analgesia induction in advance:
– metamizol (1-2.5 g) intravenously,
– paracetamol (1 g 1-2 g intravenously or rectally),
Pharmacotherapy – after surgery:

- continuous intravenous infusion of opioids (e.g. morphine, oxycodone) – at the dose determined using „titration”
- or if suitable equipment is available, the PCA with opioids can be used
  Intravenous infusion or fractionation of opioids should be combined with the use of NSAIDs (I level of credibility according to EBM):
  - metamizol (1-2.5 g, maximum 5 g / day) every 6-12 hours intravenously;
  - or paracetamol 0.5-1 g intravenously every 6 hours in combination (or not) with:
    - ketoprofen (50-100 mg) in intravenous infusion every 12 hours
    - or dexketoprofen (25 mg) intravenously every 8 hours

In the case of using NSAIDs, we should remember of the need to use a proton pump inhibitor (e.g. omeprazole 20 mg, and in patients with the increased risk of gastrointestinal bleeding, the dose should be increased to 40 mg). We should remember of the need to alleviate the so-called “breakthrough pain” by giving additional doses of opioids:

- morphine 1-2 g i.v. may be repeated after 10-15 minutes,
- oxycodone 1-2 mg i.v. may be repeated after 15 minutes,
- or oral formulation of tramadol with paracetamol.

Local analgesia

In most cases, regional analgesia is a continuation of surgical anaesthesia. Continuous epidural analgesia with the use of local anaesthetics in combination with opioids is the most commonly recommended method as it can be applied in various fields of surgery and its efficacy is satisfactory. Given the persistence of pain, an epidural catheter should be maintained until the patient is fully mobilized. However, both total dose of opioids and the concentration of a local anaesthetic should be appropriately modified based on the assessment of pain intensity. Please note that continuous epidural analgesia is an effective method in 90% of patients in this group. After some surgeries, an alternative to epidural analgesia can be as follows:

- continuous spinal anaesthesia,
- paravertebral blockade,
- intrapleural anaesthesia,
- plexus blockade.

However, as the extent of surgical trauma is greater, the expected pain is more intense and its duration is usually longer. This presents a special task for a therapeutic team, since postoperative analgesia must be conducted during prolonged rehabilitation and extended wound healing. It requires the fullest co-operation with a rehabilitation and physiotherapy team.

A discharge summary should include the compact information for patient’s family doctor about the need to continue the use of analgesics applied at the department. At discharge, the patient should be given a prescription for painkillers.

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