VIA MEDICA

ORIGINAL PAPER / GYNECOLOGY

Ginekologia Polska
2021, vol. 92, no. 2, 85–91

ISSN 0017–0011

DOI 10.5603/GP.a2020.0167

The impact of multimodal therapies on the comfort and safety of patients in the immediate post-anaesthetic period following gynaecological procedures — part I

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ABSTRACT

Objectives: Pain and postoperative nausea and vomiting are among the most unpleasant sensations experienced after surgery. Patients after gynaecological surgery are at higher risk for both complications. Former methods of pain management based mainly on opioid administration were much less safe, especially for elderly patients. In addition, they generated an even greater increase of postoperative nausea and vomiting.
Multimodal therapies in anesthesiology are currently being used more and more often. These include both multimodal postoperative pain management and multimodal prophylaxis of postoperative nausea and vomiting.
The aim of the study was to assess the benefits of the methods used for gynaecological patients in the immediate postanesthetic period.

Material and methods: The research material is an analysis of medical documentation of 150 patients from the gynaecology clinic who underwent surgical procedures of categories III and IV from October 2018 and until January 2019, carried out in one of the clinical hospitals in Szczecin at the Anesthesiology and Intensive Care Clinic. Patients were divided into 3 groups:

1. Patients who received multimodal analgesia using non-opioid and opioid analgesics.
2. Patients who received multimodal analgesia using non-opioid and opioid analgesics and adjuvants.
3. Patients who received multimodal analgesia using non-opioid and opioid analgesics and central blockade.

Results: The highest age was in the third group at 57.48 years of age, 50.86 in the second group, and 47.8 in the first group. Healthy patients classified as ASA 1 accounted for 14% of group I, 18% of group II and 10% of group III. Patients with severe systemic disease (ASA 3) constituted 30% of group III 18%, of group II and 8% of group I. Upon leaving the operating room, as many as 80% of the patients from groups II and III did not feel any pain. In group I was 52%. When entering the recovery room, 26% of the patients in group I, 10% in group III, and 8% in group II rated their pain as higher than 5. The most used antiemetic medication in the studied facility was ondansetron. In group II it was given to 36 (72%) patients, in group III to 23 (46%) patients, and 13 (26%) patients in group I. In the postanaesthetic care unit, 9 (18%) patients in group III, 6 (12%) patients in group I, and 3 (6%) patients in group II received ondansetron. Metoclopramide was given only to patients in group III — one intraoperatively, and the other in the recovery room.

Conclusions: Multimodal analgesia is effective in pain treatment. The use of PONV prevention is used for gynaecological patients. The analysis of the surgical records facilitated the recognition of patient needs.

Key words: pain; multimodal analgesia; PONV; surgical gynaecology; direct anaesthesia supervision

Ginekologia Polska 2021; 92, 2: 85–91

INTRODUCTION

Gynaecology is the discipline of medical science dealing with the diagnosis and treatment of diseases of the female genital organs. It is a field of medicine where surgical procedures are a frequent element of diagnostics and therapy.

Therapeutic success in surgical gynaecology is conditioned by many factors, from the surgeon's skills and experience, to comprehensive postoperative care. The work of the nurse in a post-anaesthetic care unit is currently particularly challenging starting from diagnosing early postoperative complications and ensuring patient safety, through participation in pain treat-

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ment, postoperative nausea and vomiting, and unintentional perioperative hypothermia. In order to provide comprehensive patient care, the anaesthesia nurse should know and understand the course of the anaesthesia, as well as the impact of specific procedures and techniques on the human body, as these elements affect the level of postoperative risk and determine and facilitate the recognition of patient needs.

The aim of the study was to assess the effectiveness of multimodal analgesia on pain and vomiting in the immediate postoperative period. The second part of the study presents theeffects of the types of anaesthesia along with multimodal analgesia on the stability of vital functions at the critical moment of awakening from anaesthesia.

MATERIALS AND METHODS

The material comprised the medical records at the Department of Anaesthesiology and Intensive Care at one of the clinical hospitals in Szczecin. The Directorate's consent to use the medical records was obtained before the material was collected. The anaesthesia record forms and recovery room observation charts of 150 patients from the Gynaecology Clinic who had undergone category III and IV surgical procedures between October 2018 and January 2019 were selected for analysis. Originally, the data collected concerned 193 patients. After a preliminary analysis, the patients who had undergone category II surgical procedures were excluded from the study. The remaining patients were divided into three groups:

1. Patients given multimodal analgesia with non-opioid and opioid analgesics.
2. Patients given multimodal analgesia with non-opioid analgesics and adjuvants.
3. Patients given multimodal analgesia with non-opioid and opioid analgesics, as well as neuraxial anaesthesia. Group I was also a control group.

For statistical analysis, Excel 2019, the Shapiro-Wilk test, Mann-Whitney-Wilcoxon test and Boschloo tests were applied, using the R environment for statistical computing.

RESULTS

The average age of the patients differed in each group. The highest age was in the third group at 57.48 years of age, 50.86 years in the second group, and 47.8 years in the first group (Fig. 1).

The lowest average body weight was found for group III at 65.88 kg. It was highest for group II at 71.9 kg, and for group I at 70.4 kg. Due to the administration of many medications, such as opioids, the body weight values were divided into three intervals: up to 50 kg, from 50 to 70 kg, and over 70 kg (Fig. 2).

Healthy patients classified as ASA 1 accounted for 14% of group I, 18% of group II and 10% of group III. Patients with severe systemic disease (ASA 3) constituted 30% of group III 18%, of group II and 8% of group I (Fig. 3).

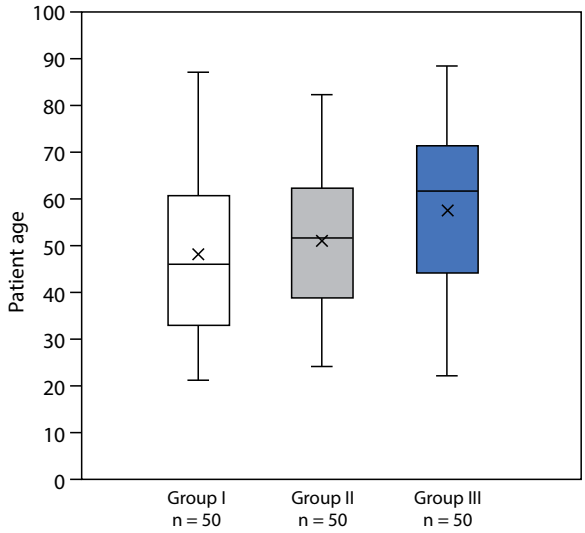

Figure 1. The distribution of patient age in particular groups

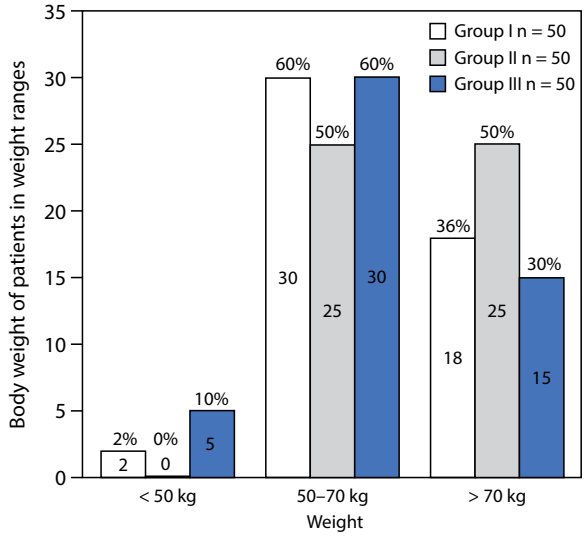

Figure 2. Body weight of patients from particular groups in weight ranges

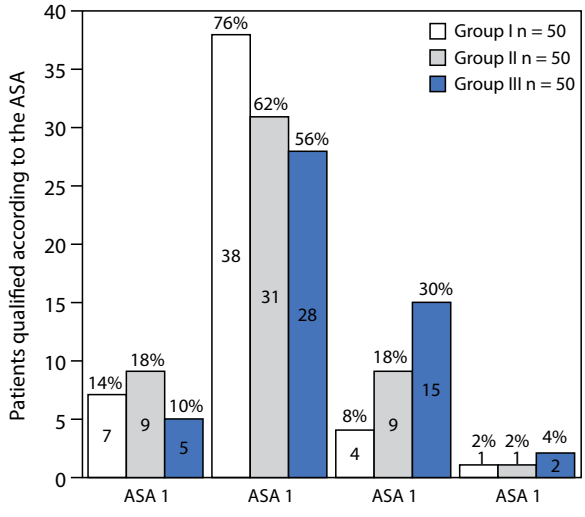

Figure 3. Patients qualified to the ASA scale

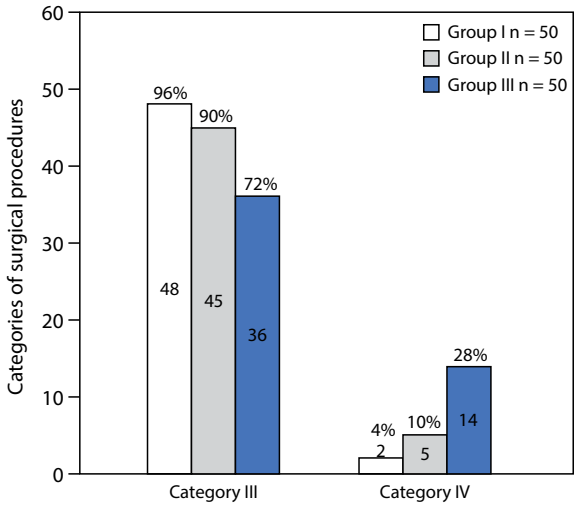

Figure 4. Categories of surgical procedures by the degree of damage

The length of the procedures was divided into four intervals: up to 1 hour, between 1–2 hours, between 2–4 hours, and over 4 hours. There were 7 (14%) procedures lasting up to 1 hour in group I, 10 (20%) in group II, and 3 (6%) in group III. More than half of the procedures lasted from one to two hours in groups I and II, which is 28 (56%) in group I and 26 (52%) in group II, and much less in group III — 16 (32%). The greatest number of procedures lasting from two to four hours were in group III — 22% (44%). In other groups their number was comparable — 12 (24%) in group I and 13 (26%) in group II. There were significantly more procedures lasting over 4 hours in group III — 18%, compared to group II — 2% and group I — 6%. Category III surgical procedures, associated with extensive tissue damage, were predominant in each group, 96% in group I, 90% in group II, and 72% in group III. Analogically, the greatest number of procedures associated with extensive tissue damage, *i.e.* category IV, was observed in group III — 28%, while in the remaining groups they constituted no more than 10%.

Category III surgical procedures, associated with extensive tissue damage, constituted 96% in group I, 90% in group II, and 72% in group III. Analogically, the largest number of procedures associated with extensive tissue damage, category IV, was in group III — 28%, while in the remaining groups they constituted no more than 10% (Fig 4).

The intraoperative doses of opioids administered during anaesthesia are presented in Table 1. If analgesia administered intraoperatively was insufficient, it was continued

Table 1. Intraoperative medications administered during anaesthesia

Doses of opioids administered during anaesthesia					
		GI (n = 50)	GII (n = 50)	GIII (n = 50)	
Fentanyl in mg					
Dose of fentanyl in mg	lack	0	0	3 (6%)	
	0.05–0.1	4 (8%)	11 (22%)	24 (48%)	
	0.1–0.2	8 (16 %)	1 (2%)	18 (36%)	
	0.2–0.3	28 (56%)	27 (54%)	3 (6%)	
	0.3–0.4	9 (18%)	11 (22%)	2 (4%)	
	0.4–0.5	1 (2%)	0	0	
Oxycodone in mg					
Dose of oxycodone in mg	lack	36 (72%)	29 (58%)	46 (92%)	
	0–2	1 (2%)	3 (6%)	3 (6%)	
	2–4	6 (12%)	11 (22%)	1 (2%)	
	4–6	7 (14%)	6 (12%)	0	
	6–8	0	1 (2%)	0	
	8–10	0	0	0	
Morphine in mg					
Dose of morphine in mg	lack	46 (92%)	46 (92%)	48 (96%)	
	0–2	0	0	0	
	2–4	2 (4%)	1 (2%)	1 (2%)	
	4–6	2 (4%)	2 (4%)	0	
	6–8	0	0	0	
	8–10	0	1 (2%)	1 (2%)	

Table 2. Doses of opioids given in the recovery room to patients with low postoperative pain rated as 0–4 on the NRS scale

Doses of opioids administered during anaesthesia					
		G I (n = 50)	GII (n = 50)	GIII (n = 50)	p
Fentanyl in mg					
Oxycodone in mg					
Dose of oxycodone in mg	lack	20 (40%)	23 (46%)	33 (66%)	G1 0.00207 GII 0.000635 GIII 0.0000219
	0–2	3 (6%)	1 (2%)	2 (4%)	
	2–4	4 (8%)	11 (22%)	6 (12%)	
	4–6	11 (22%)	11 (22%)	6 (12%)	
	6–8	10 (20%)	3 (6%)	2 (4%)	
	8–10	1 (2%)	0	0	
Morphine in mg					
Dose of morphine in mg	lack	46 (92%)	46 (92%)	41 (82%)	G1 vs G2 0.3661352 G1 vs GIII 0.00009917 GII vs GIII 0.00000194219
	0–2	1 (2%)	0	1 (2%)	
	2–4	3 (6%)	1 (2%)	2 (4%)	
	4–6	0	2 (4%)	2 (4%)	
	6–8	0	0	4 (8%)	
	8–10	0	0	0	

in the postanaesthetic care unit. In group I, 20 patients (40%), in group II — 23 patients (46%), and in group III — 33 (66%) did not require oxycodone. Since the continuation of analgesic treatment is associated with increased doses of opioids, the doses of morphine and oxycodone given in the operating room and the postanaesthetic care unit were added together. In groups I and II, the number of patients not requiring oxycodone was similar — 16 (32%) in group I and 14 (28%) in group II, while in group III it was more than twice as high — 33 (66%) patients (Tab. 2).

Since the length of the patients' stay in the postanaesthetic care unit varied, pain intensity on awakening and the maximum level of pain recorded in the recovery room were compared. When leaving the recovery room, none of the women rated their pain as higher than 2, according to the NRS scale.

On leaving the operating room, as many as 80% of the patients from groups II and III did not feel any pain. In group I it was 52% (Fig. 5 and 7). When entering the recovery room, 26% of the patients in group I, 10% in group III, and 8% in group II rated their pain as higher than 5 (p = 0.06153).

In the recovery room paracetamol was administered to 7 patients in group III, 2 patients in group I, and 1 patient in group II. After leaving the operating room, 18% of the patients in group III, 10% in group I, and 8% in group II received metamizole. The detailed distribution of administered medications is presented in Figure 6.

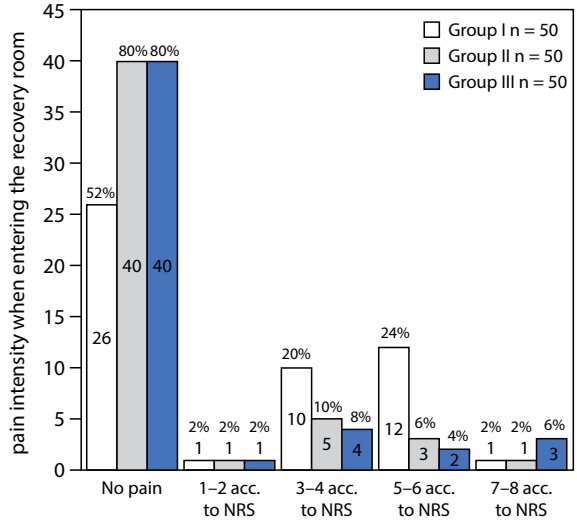

Figure 5. Pain intensity on awakening

Other anesthetic drugs given during anesthesia

The most used antiemetic medication in the studied facility was ondansetron. In group II it was given to 36 (72%), in group III to 23 (46%), and in group I to 13 (26%) patients. In the postanaesthetic care unit, 9 (18%) patients in group III, 6 (12%) patients in group I, and 3 (6%) patients in group II received ondansetron (Fig. 8 and 9). Metoclopramide was

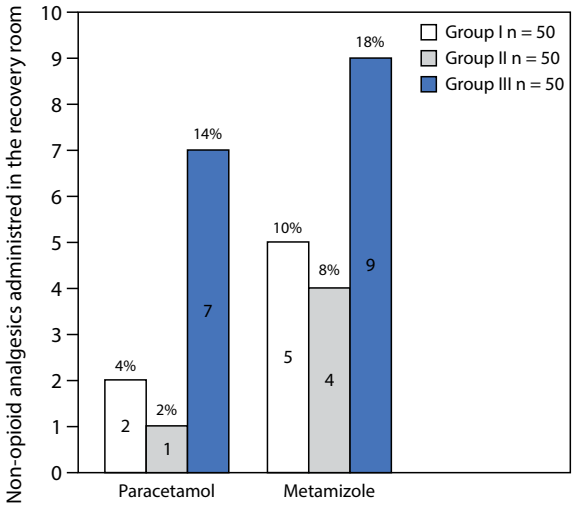

Figure 6. Non-opioid analgesics administered in the post-anaesthetic care unit

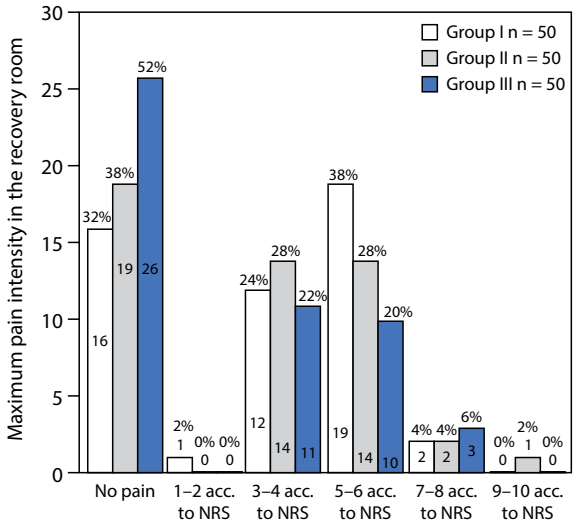

Figure 7. Maximum pain intensity in the recovery room (NRS scale)

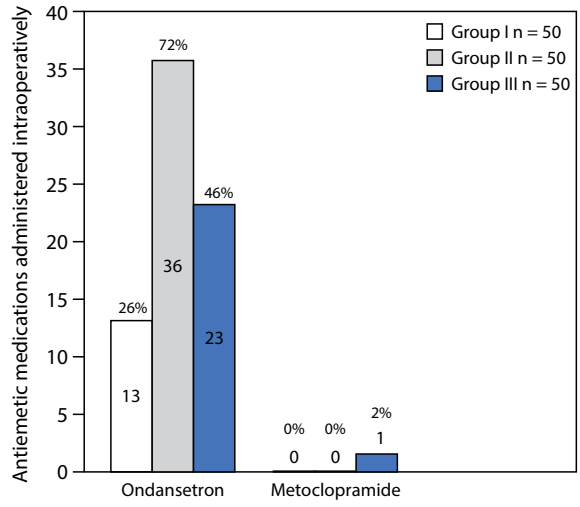

Figure 8. Antiemetic medications administered intraoperatively

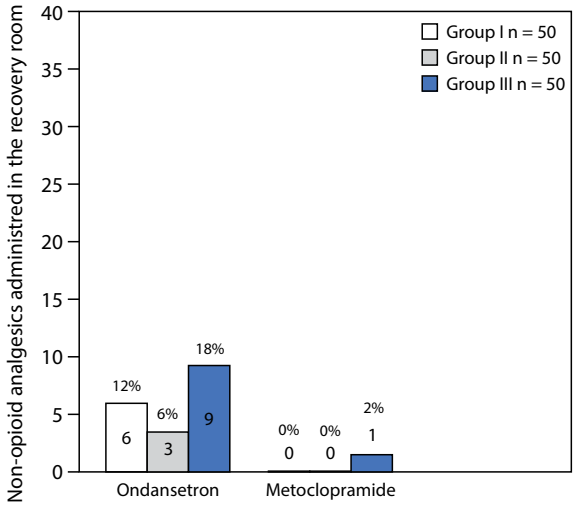

Figure 9. Antiemetic medications the recovery room

given only to patients in group III — one intraoperatively, and the other in the recovery room (p = 0.03503).

DISCUSSION

The ERAS protocol, first outlined by Danish surgeon Henrik Kehlet in the 1990s, assumes that the development of postoperative complications is influenced not only by the surgical procedure and anaesthesia, but also by the perioperative management. Older age increases the likelihood of diseases requiring surgical treatment, thus the number of older patients undergoing surgeries is increasing. Old age is an additional independent risk factor for increased perioperative mortality. Therefore, the implementation of comprehensive postoperative care increases the chance of an uncomplicated postoperative course. The elements of such care include analgesic treatment, prevention of nausea and vomiting, as well as maintenance of normothermia.

The results of the conducted analysis varied greatly between the groups. One differentiating factor was the age of the patients. In each group, the age of the patients ranged from 20 to more than 80 years, yet in group III more than half of the patients were older than 60 years of age. This relates to surgical risk, as in group III 34% of the patients were classified as ASA 3 and 4. This is three times more than in group I, where such patients accounted for 10%. The length of the surgical procedure also varied greatly in the groups. In groups I and II, the highest number of procedures lasting up to two hours — about 70–72% was recorded. In group III, it is the exact opposite. 62% of surgeries lasted over two hours. This also translates into the category of damage. Category IV procedures, with extensive tissue damage, concerned 28% of the patients from group III, 10% of the patients from group II, and 4% of the patients from group I. The conducted analysis confirms that older patients were in a worse physical

condition. According to the Central Statistical Office (GUS) in Poland, 88.3% of people aged 80 years or over and 77.1% of people aged 70 years complain about chronic diseases [1]. This translates into higher surgical risk and extensive surgical procedures, mainly due to oncological reasons.

Analysis of the doses of fentanyl during surgery shows that the doses in group III where neuraxial anaesthesia was applied were different than in groups I and II. A single bolus administration (1–3 μg/kg) is short acting, *i.e.* 0.1–0.2 mg usually works for less than an hour. At high doses (> 20 μg/kg), however, the end of action depends on slow elimination processes and fentanyl becomes a long-acting drug [2]. Additionally, in elderly people, the dose is reduced with age: from 65 to 74 years of age by 20%, from 75 to 85 years of age by 50%, over 85 years of age by 60% [3]. The analysis of the medical charts showed that in group III 90% of the patients received a dose of fentanyl not greater than 0.2 mg. In groups I and II, 76% of the patients received a dose higher than 0.2 mg with relatively shorter surgical procedures.

During surgical procedures other opioids were also administered in advance in the studied groups: oxycodone and morphine. Oxycodone was administered to 28% of the patients in group I, 42% in group II, and 8% in group III. 8% of the patients in groups I and II, and 4% of the patients in group III received morphine. In the post-anaesthetic care unit, oxycodone was administered to 60% of the patients in group I, 54% in group II, and 34% in group III. In the recovery room, morphine was administered to 18% of the patients in group I, and to 8% from groups II and III. When analysing the data, it can be concluded that oxycodone was used much more freely than morphine. This is justified in the case of oxycodone, as compared to other opioids the adverse effects, particularly symptoms from the central nervous system, nausea and vomiting, are much less frequent [4, 5], the lessening of which is important, especially in gynaecological patients. Moreover, oxycodone is more effective than morphine in the treatment of visceral pain. It also has a slightly different tolerance profile — smaller blood pressure drops and a lesser sedative effect than morphine, which is beneficial especially in obese patients [6]. Besides, the analysis showed that in groups without neuraxial anaesthesia, the use of opioids was more frequent, and the doses were higher. The statistical analysis showed, similarly to fentanyl, that the distribution of morphine and oxycodone doses were different among patients rating their pain no higher than 4 on the NRS scale. The concentration of values at zero was greatest in group III, where the largest number of patients where neuraxial anaesthesia was applied did not require opioids in the recovery room. The analgesic efficacy of neuraxial anaesthesia is greatly beneficial in terms of reducing opioid doses, especially in older people.

Pain management through the use of neuraxial anaesthesia is recommended by the Section of Regional Anaesthesia and Pain Therapy of the Polish Society of Anaesthesiology and Intensive Therapy, the Polish Society of Regional Anaesthesia and Pain Therapy, the Polish Association for the Study of Pain and the National Consultant in Anaesthesiology and Intensive Therapy from 2018, where neuraxial anaesthesia is recommended in postoperative analgesia after open chest and abdomen procedures, particularly in patients at risk of cardiac and pulmonary complications, or prolonged intestinal atonia with the risk of obstruction [7, 8].

Metamizole and paracetamol are standard painkillers used in accordance with the recommendations for treatment of postoperative pain, as well as with the WHO analgesic ladder. The analysis showed that paracetamol was used in the perioperative period for 96% of the patients in group I, 90% in group II, and 82% in group III. Metamizole was administered to 90% of the patients from group II, and 76% of the patients from groups I and III.

Metamizole is an extraordinarily strong analgesic and antipyretic medication that has been used worldwide for 98 years. Its efficacy was confirmed in the German university centre in Ulm, where randomised double-blind trials were conducted in which patients after abdominal surgery, mainly laparoscopic cholecystectomies, were given 1 g of metamizole or a placebo every six hours. In the control group, analgesia with buprenorphine was applied. Parallel administration of metamizole reduced the use of opioid to 1/3 of the control group dose [9].

Paracetamol, like metamizole, has both analgesic and antipyretic effects. Because of its intravenous form, it can be used in patients after surgical procedures. Fijałkowska A. et al. confirms the usefulness of paracetamol after gynaecological, particularly laparoscopic procedures. After laparotomy, administration of paracetamol requires multimodal management for the first 12 postoperative hours [10].

In multimodal pain therapy, positive effects are also achieved by associating paracetamol and metamizole with opioids. Administration of paracetamol with morphine results in an additional analgesic effect. Such a combination allows a reduction in dose of both analgesics, yet the dose of paracetamol necessary to achieve the satisfactory analgesic effect remains high [11].

The treatment of postoperative pain is multidimensional and should be as effective as possible with the minimal possible side effects. The conducted analysis shows that the highest effectiveness was achieved in group III. More than 50% of the patients did not feel pain in the recovery room. For groups II and I the number was over 30%. Maximum pain levels recorded in the recovery room of 1 to 4 on the NRS scale were reported by over 20% of the patients. A minimum pain level of 5 or higher was rat-

ed by 40% of the patients in group I, 34% in group II, and 26% in group III. To enable the patients to leave the recovery room with a reported pain level no higher than 2, opioids were most commonly used. The doses of morphine or oxycodone per kg body weight were compared. The results show different dosing distributions for groups I and II, as well as for groups I and III. The concentration of values at zero was the highest in group III, which means that most patients from this group did not require the administration of opioids.

Prevention of postoperative vomiting and nausea is another essential component of quality comprehensive perioperative care. Propofol, recommended for the induction of anaesthesia to prevent PONV, was used for all patients in groups I and II. In group III, 6% received etomidate as a result of their cardiovascular diseases, and 10% did not require propofol as the standard anaesthesia was sufficient. Halogen-containing anaesthetics were used in all patients under general anaesthesia — this risk factor was not reduced. Nitrous oxide was not used.

In multimodal therapies, doses of opioids are minimised by the use different types of analgesics. Neostigmine was given to 62% of the patients in groups I and II, and 38% of the patients in group III. Sugammadex is not routinely used due to its high price and was administered to less than 20% of the patients in groups I and II, and 10% of the patients in group III. As far as PONV-preventing medications are concerned, dexamethasone was used only in group II, in which coanalgesics were added to the multimodal analgesia methods for 88% of those patients. Ondansetron was most frequently used in group II — 72% of the patients received it intraoperatively. In group III, it was given to 46% of the patients, and in group I — 26%. Postoperative nausea and vomiting occurred in less than 20% of the patients in all groups, in just 4% of the patients in group II, 12% in group I, and 16% in group III.

The relationship between the administration of antiemetic medications (dexamethasone and ondansetron) to PONV was studied. The results confirm the efficacy of the intraoperative use of dexamethasone and ondansetron for PONV prevention and are consistent with Paxton et al. who studied 118 patients after gynaecological laparoscopy, comparing the prophylactic effects of ondansetron, DHBP and metoclopramide. Ondansetron was most effective in the first 4 hours after surgery [12]. Similar results were obtained by Świątkowski et al. in a study of 126 patients in four randomly selected groups. The control group consisted of patients that did not receive the studied medications. Ondansetron (4 mg), dehydrobenzperidol (DHBP) (75 mg kg–1) or metoclopramide (0.4 mg kg–1) were administered intravenously immediately after the induction of general anaesthesia. Ondansetron and DHBP caused a statistically significant increase in the number of PONV-free patients and a decrease in intensity and frequency of PONV symptoms in the first 6 hours after surgery, compared to the control group. No significant differences in prophylactic efficacy of either medication were observed [13].

The effectiveness of dexamethasone in PONV prevention has been confirmed in many scientific studies. De Oliveira GS Jr. et al. [14], in an updated meta-analysis of randomised controlled trials, confirm that a dose of dexamethasone from 4 to 5 mg has a similar clinical effect in PONV prevention as a dose from 8 to 10 mg, irrespective of whether the medication is used individually or in combination therapy.

RESULTS

1. Multimodal analgesia is effective in pain treatment.
2. The use of PONV prevention is used for gynaecological patients.
3. The analysis of the surgical records facilitated the recognition of patient needs.

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