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EVALUATION OF PAIN SYNDROME AND EFFICIENCY OF PAIN MANAGEMENT IN LUMBAR SPINE SURGERY

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Abstract

Multimodal analgesia for lumbar spine surgery is still a controversial problem, because of possible fusion problems, significant neuropathic component of pain, and influence of anesthesia type. **Aim of the study** was to assess the efficacy of pain management after lumbar spine surgery considering characteristics of pain, type of anesthesia and analgesic regimen.

Material and methods. 254 ASA I–II patients with degenerative lumbar spine disease were enrolled into prospective study. Patients were operated either under spinal anesthesia (SA) or total intravenous anesthesia (TIVA). In postoperative period patients got either standard pain management (SPM – paracetamol±morphine) or multimodal analgesia (MMA – paracetamol+parecoxib+ +pregabalin±morphine).

Results. We revealed neuropathic pain in 53.9 % of patients, who were elected for lumbar spine surgery. VAS pain score in patients with neuropathic pain was higher, than in patients with nociceptive pain. Total intravenous anesthesia was associated with greater opioid consumption during the first postoperative day. Multimodal analgesia based on paracetamol, parecoxib and pregabalin allowed to decrease requirements for opioids, postoperative nausea and dizziness. Pregabalin used for evening premedication had equipotential anxiolytic effect as phenazepam without postoperative cognitive disturbances.

Conclusions. Multimodal analgesia is opioid-sparing technique that allows to decrease complications. Spinal anesthesia is associated to a decreased opioid consumption in the 1st postoperative day.

Keywords: lumbar spine surgery, anesthesia, multimodal analgesia.

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1. Introduction

Effective pain management is one of cornerstones of enhanced recovery after surgery [1]. It allows early mobilization and reduces rate of complications. Unfortunately, half of patients still suffer from moderate to severe postoperative pain [2] that can lead to hyperalgesia and chronic pain. Another reason of poorly treated pain in patients with lumbar spine diseases is its complex characteristics [3] and a significant influence of neuropathic component [4]. Several years ago, spine surgeons very reluctantly used multimodal analgesia (MMA) because of risk of incomplete spinal fusion after using of non-steroid anti-inflammatory drugs (NSAID). However, the recent papers [5] with high level of evidence have shown safety of routine postoperative usage of NSAIDs. It proved that using of selective COX-2 inhibitors and short term using of small doses of non-selective COX inhibitors did not influence the rate of fusion after spine surgery. The influence of anesthesia type on postoperative pain after lumbar spine surgery is also controversial [6, 7].

Aim of the study was to assess the efficacy of pain management after lumbar spine surgery considering characteristics of pain, type of anesthesia and analgesic regimen.

2. Material and methods

After approval of local ethics committee (14.09.2015, protocol №147) the prospective randomized trial was performed in SI "Sytenko Institute of Spine and Joint Pathology NAMS of Ukraine" in 2015–2019, 254 ASA I-II patients were enrolled. All patients were elected for lumbar spine surgery in prone position because of degenerative lumbar spine diseases (disc herniation, degenerative spondylolisthesis, vertebral canal stenosis). Duration of surgery did not exceed 3 hours. Patients were divided into 4 groups. Patients of the group SA/SPM (n=72) were operated under spinal anesthesia and obtained standard pain management, patients of the group TIVA/SPM (n=55) were operated under total intravenous anesthesia and obtained standard pain management. Standard pain management included paracetamol 1 g 3 times and morphine if pain intensity (Visual Analog Score – VAS) was greater than 4. For anxiolytic premedication patients of SPM subgroups obtained phenazepam 0,5 mg 12 hours before surgery. Patients of group SA/MMA (n=72) were operated under spinal anesthesia with multimodal postoperative analgesia, and patients of group TIVA/MMA (n=55) were operated under total intravenous anesthesia with multimodal postoperative analgesia. Patients of MMA subgroups obtained additionally pregabalin 75 mg orally with preoperative start 12 hours before surgery and then twice a day and parecoxib 40 mg twice a day. Patients of MMA subgroup were not premedicated with phenazepam, as pregabalin has also anxiolytic effect.

All patients signed an informed consent to participate in the investigation.

Patients in the groups did not differ according to age, sex, and body mass index.

To evaluate the prevalence of neuropathic or nociceptive pain component we used DN4 (Douleur Neuropathic Pain Diagnostic Questionnaire). Score 4 and more is known to be specific for neuropathic pain [8].

Severity of pain was assessed using visual analogue scale (1-10 points). Efficiency of analgesia was assessed by standard criteria: time of the first requirement of morphine, average morphine consumption during 24 hours. We noted also anesthesia/opioid-related complications in early postoperative period: dizziness, postoperative nausea and vomiting (PONV). Patients evaluated these signs from 1 point (absence) to 5 (maximal). We administered PONV prophylaxis and treatment according to protocol.

For evaluating of preoperative anxiety, we used APAIS-A (Amsterdam Preoperative Anxiety and Information Scale – Anxiety), which is considered to be one the most valid anxiety scales for scientific work and clinical practice [9]. It consists of 4 questions with answers rating from 1 to 4.

1. I am worried about the anesthetic.
2. The anesthetic is on my mind continually.
3. I am worried about the procedure.
4. The procedure is on my mind continually.

The anxiety level was determined just before surgery in pre-anesthesia unit.

The sum of points may be from 4 to 20. The level 10 and more points is considered the strong anxiety.

Cognitive function was assed using quick Trail Making Test [10]. Investigation was performed the day before surgery and 3rd day after surgery.

Statistical analysis was performed using IBM SPSS 9.0. Distribution of data was estimated as normal (Kolmogorov-Smirnov Test). Comparing of groups was performed with Student test. Obtained data were presented as M±SD.

3. Results

3. 1. Evaluation of pain characteristics in preoperative period.

Neuropathic pain was determined in 53,9 % of patients before surgery. We did not find any correlation with duration of pain. The number of patients with neuropathic pain in all groups did not differ. Interestingly, women were more prone to neuropathic pain, than men were (**Table 1**).

Table 1

Characteristics of patients depending of the type of pain, M±SD

Type of pain	Age, years	Men/Women, Nabs (P±SP)	Body mass index, kg/m²	Duration of pain, months	Intensity of pain at rest, VAS	Intensity of pain at movements, VAS
Patients with nociceptive pain (n=117)	43.1±9.2	76/43 (65±٤/35±٥ %)	28.3±2.3	5.5±4.7	3.4±2.9	5.7±2.8
Patients with neuropathic pain (n=137)	48.5±10.7	61/76 (45±٦/55±٥ %)	28.5±6.5	4.9±4.2	5.5±1.7*	7.7±1.5*

*Note: * – statistically significant difference comparing with nociceptive pain patients, p<0.05*

Intensity of pain (VAS) was more significant in patients with neuropathic pain (**Table 1**) comparing to patients with nociceptive pain (5.1±1.7 points vs 3.4±2.9 points at rest and 7.7± ±1.5 points vs 5.7±2.8 points at movements). These data correspond to recent paper from Korea [11].

Considering high percentage of neuropathic pain in degenerative lumbar spine diseases, we used pregabalin for premedication and postoperative analgesia.

3. 2. Evaluation of pain syndrome in patients of the examined groups in postoperative period

The distribution of patients with both types of pain in the examined groups was uniform.

In both MMA subgroups time of the first requirement of morphine was bigger (**Table 2**), than in patients with standard analgesia (p<0.05). Average morphine consumption during 24 hours was the biggest in the group TIVA/SPM. This parameter was significantly bigger, than in patients of all another groups (p<0.05). Seven patients (12.7 %) of group SA/MMA and eleven patients (15.7 %) of group TIVA/MMA did not require opioids for postoperative analgesia.

Table 2

Characteristics of postoperative pain (at movements) in patients of the examined groups, M±SD

Groups of Patients	VAS, points			Opioid requirements	
	Pain before surgery	Pain on the 3rd postop day	Pain on the 7th postop day	First requirement of morphine, min	Morphine consumption 24 hours, mg
SA/SPM (n=72)	6.5±2.4	2.4±2.1	1.5±1.1	170±134	29.4±11.9
SA/MMA (n=72)	6.6±2.3	2.3±1.9	1.3±0.9	218±121*	16.5±8.5
TIVA/SPM (n=55)	6.8±2.1	2.5±2.2	1.4±1.0	178±117	37.7±12.1**
TIVA/MMA (n=55)	6.6±2.1	2.3±1.8	1.4±1.1	231±140*	18.4±9.2

*Note: * – p<0.05 comparing with SPM subgroups; ** – p<0.05 comparing to SA subgroups*

We examined level of postoperative nausea, vomiting and dizziness during 2 days of postoperative period (**Table 3**). We revealed, that incidence of postoperative nausea was significantly higher in the group with standard analgesia after both types of anesthesia. The incidence of dizziness was the highest in the group TIVA/SPM.

Table 3

Postoperative nausea, vomiting and dizziness in patients of the examined groups according to self assessment, points, M±SD

Group of patients	Nausea	Vomiting	Dizziness
SA/SPM (n=72)	1.4±0.4	1.1±0.3	1.6±0.5
SA/MMA (n=72)	1.1±0.2*	1.1±0.2	1.4±0.4
TIVA/SPM (n=55)	1.9±0.5**	1.2±0.4	2.1±0.5
TIVA/MMA (n=55)	1.3±0.4*	1.2±0.3	1.4±0.3*

*Note: * – p<0.05 comparing to SPM subgroups; ** – p<0.05 comparing to SA subgroups*

3. 3. Evaluation of anxiolytic effect and cognitive function in patients of the examined groups in perioperative period.

Premedication with phenazepam and pregabalin had the equivalent influence on the level of agitation in all groups of patients (**Table 4**). High level of agitation (10 points and more) was revealed in 5 (6.9 %) patients of the group SA/SPM, in 6 (8.3 %) patients of the group SA/MMA, in 4 (7.3 %) patients of the group TIVA/SPM, and in 5 (9.0 %) of the patients of the group TIVA/MMA with no difference between groups.

Table 4

Agitation and cognitive function of patients in perioperative period

Group of patients	Level of agitation, APAIS-A, points	Trail Making Test before surgery, sec	Trail making Test 3rd day after surgery, sec
SA/SPM (n=72)	8.2±2.9	63.1±16.3	87.3±27.2* **
SA/MMA (n=72)	7.9±2.6	58.4±19.8	57.4±23.8
TIVA/SPM (n=55)	7.8±2.1	61.1±18.5	92.1±25.1* **
TIVA/MMA (n=55)	8.1±2.5	57.9±17.4	61.8±19.8

*Note: * – p<0.05 comparing to MMA subgroup; ** – p<0.05 comparing to preoperative level*

Trail making test (TMT) in preoperative period was the same in patients of all groups. On the 3rd day after surgery TMT in patients of all groups with standard analgesia and phenazepam premedication was significantly longer, than preoperative level (in the group SA/SPM 87.3±27.2 sec vs 63.1±16.3 sec, p<0.05, in the group TIVA/SPM 92.1±25.1 sec vs 61.±18.5 sec, p<0.05), and longer than the same indices of subgroups MMA (87.3±27.2 sec vs 57.4±23.8 sec, p<0.05 in the group SA and 92.1±25.1 vs 61.8±19.8 sec, p<0.05 in the TIVA group). Thus, anesthesia type does not influence significantly on postoperative cognitive function. Using of phenazepam for premedication may have negative influence on postoperative cognitive function. Pregabalin premedication as a component of MMA instead of phenazepam seems to be more expedient, as it has the same anxiolytic effect with absence of postoperative cognitive dysfunction.

4. Discussion

Isaikin A. et al. in their paper [12] also aimed to describe chronic low back pain. They found neuropathic pain only in 28 % of patients. But group of patients was small (40 patients) and they were much older (mean age was 69.9 y.o.). In another big multicenter study of 1109 patients with low back pain [11] authors found 36.4 % of neuropathic pain. They used another tool to measure pain characteristics – Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) and their

patients were also older than in our investigation. Very similar to our data were obtained by investigators from Japan [13]. They examined 1857 patients with spine disorders and found that overall prevalence of neuropathic pain was 53.3 %.

Influence of the type of anesthesia on postoperative pain is controversial. Meng T. et al. in meta-analysis [7] showed decreasing of morphine consumption in the recovery room (but not total amount of morphine in postop period) after spinal anesthesia comparing to general anesthesia. Authors also revealed significantly lower incidence of PONV after spinal anesthesia for lumbar spine surgery. High efficacy and safety of MMA in lumbar spine surgery was demonstrated in the recent paper granted by AO Spine [14]. Authors have shown that using of combination paracetamol/ketorolac/pregabalin allowed to decrease narcotic requirements, and length of stay. These data are correspond to our data and requirements to modern ERAS protocols.

Generally, for postoperative analgesia for lumbar spine surgery the most effective and safe were thought to be opioids and paracetamol [15]. The overall tone of the spine literature in the early 2000s was that NSAIDs increased the rate of non-union; however, nearly all human studies published after 2005 suggest that short-term (<2 weeks) postoperative use have no such effect. The dose dependency that is seen with a 2-week postoperative course is not present when NSAIDs are only used for 48 h after surgery [16]. That is why we used parecoxib only for 48 hours after surgery to minimize conflict of interest with surgeons.

Today very limited data are present according to usage of pregabalin for preemptive and postoperative analgesia for spine surgery [17]. But the meta-analyze have shown that analgesic efficacy and opioid-sparing effects were observed with the administration of pregabalin for spine surgery. Additionally, a significant decrease in the risk of nausea was associated with the use of pregabalin.

High efficacy of pregabalin for lumbar spine surgery were also shown in paper [18]. Authors showed a significantly lower rate of neuropathic chronic postoperative pain in pregabalin group at 2 and 6 months after surgery. Anxiolytic effect of pregabalin premedication was also demonstrated in recent papers [19, 20], but the investigation were not related to spine surgery.

Our study has several limitations. We did not assess pain level longer, than 7 days (usually it was the discharge day). That is why we cannot analyze chronic pain development. Secondly, we assessed cognitive functions only in early postoperative period, that was the 3rd day.

Despite some limitations of our study, we can conclude, that multimodal analgesia based on paracetamol/pregabalin/parecoxib is safe and effective for pain management for elective lumbar spine surgery.

Prospects for further research. It seems for us very perspective to provide more longitudinal studies to analyze the influence of anesthesia and postoperative pain management on recovery after lumbar spine surgery. Modern ERAS protocols prefer to avoid premedication before surgery, although patients still suffer from anxiety. Further studies are needed to find the most safe and comfortable anxiolytic premedication.

5. Conclusions

Neuropathic pain was determined in 53.9 % of patients, who were elected for lumbar spine surgery. VAS pain score in patients with neuropathic pain was higher, than in patients with nociceptive pain.

Total intravenous anesthesia was associated with greater opioid consumption during the first postoperative day.

Multimodal analgesia based on paracetamol, parecoxib and pregabalin allows to decrease requirements for opioids, postoperative nausea and dizziness.

Pregabalin used for evening premedication has equipotential anxiolytic effect as phenazepam without postoperative cognitive disturbances.

Conflict of interests

No conflict of interest.

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