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ORIGINAL ARTICLE

Factors influencing inguinal hernia symptoms and preoperative evaluation of symptoms by patients: results of a prospective study including 1647 patients

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Abstract

Background Current recommendations for hernia treatment suggest applying techniques aimed at reducing postoperative pain in patients experiencing intense preoperative pain. However, there is still no reliable stratification method of preoperative pain, its circumstances, intensity and frequency, and the current assessments of hernia symptoms are performed by means of a subjective evaluation. The aim of this work is to discuss preoperative pain before hernia repair and determine its nature depending on the type and length of hernia persistence and the patient's age.

Materials and methods The data from 1647 patients before inguinal hernia repairs (2010–2017) were registered prospectively in the National Hernia Repair Register (demographic data, pain score and influence on everyday activities).

Results The most common symptom upon admission was pain (949 patients at rest; 57.6% and 1561 at physical activity; 94.8%). A significant influence of hernia persistence on the pain occurrence and intensity was not observed between patients with hernia < 12-months (60.8%;VAS5.0) and > 5-years (58.3%;VAS5.4) ($p = 0.068$). The occurrence and intensity of pain was significantly higher patients < 40-years (63.7%;VAS5.4) than patients > 60-years (54.3%;VAS4.8) ($p = 0.008$).

Conclusions While pain at rest is not a significant problem, undertaking physical activities may intensify pain and increase the number of patients suffering from it. Preoperative assessment of pain may help determine the group of younger patients who could benefit the most from inguinal hernia repair. New indications for prompter admission for treatment should be planned in future studies of patients showing pain at rest for possible prevention of postoperative neuropathy.

Keywords Inguinal hernia · Pain · Quality of life · Hernia repair · Symptoms · Preoperative

Introduction

Inguinal hernias are the most common surgical conditions in the world, and inguinal hernia repairs are one of the most common reasons for surgical intervention in everyday surgical practice. The risk of developing hernia throughout life amounts to 27% for men and 3% for women [1]. Up to 10% of all hernias require emergency surgical interventions; thus, proper diagnoses and treatment at the right time are of the essence.

Despite the fact that hernias occur commonly, there is still insufficient detailed information regarding the specific symptoms in the natural course of the untreated illness and the risk of developing complications. It results in a constant evolution of indications for operative treatment, from watchful waiting to surgical treatment of all hernias [2, 3]. Even in patients with no preoperative symptoms, performing a repair is suggested in selected cases, as the symptoms will occur with time, but the decision must be preceded by comprehensive information about the risk of chronic postoperative pain [4]. Among the symptoms reported by patients prior to surgery, special attention is given to the occurrence of pain and discomfort in the groin region. However, there is

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no comprehensive discussion of the nature of such pain or its circumstances, intensity and frequency. Simultaneously, the occurrence of postoperative pain is strongly emphasized, both with regard to chronic pain and other symptoms associated with the groin [5]. The appearance of such postoperative pain may in some cases be a reason that patients submit claims against the surgeons [6]. The situations occur despite the fact that usually there is no information regarding which of the ailments reported in the claim really occurred before the treatment. Additionally, some patients suffering from chronic pain must undergo additional treatment because of these ailments (mesh removal; triple neurectomy) [7]. Current recommendations for hernia treatment suggest applying techniques aimed at reducing postoperative pain in groups of patients who experience intense preoperative pain and to inform the patients about such risk in informed consent [8]. However, there is still no reliable stratification method of preoperative pain, and the current assessments of hernia symptoms are performed by means of a subjective evaluation. Hernia occurrence also influences socioeconomic burden, as every seventh patient is forced to use sick leave due to pain. At the same time, every third patient draws attention to the fact that hernia interferes with their leisure activities [9]. While qualifying patients for surgeries, three diagnostic aspects should be taken into account: preliminary symptoms, appearance of a protrusion in the groin, and the role of ultrasound [10, 11]. While the two last aspects are well discussed in the literature, there is no detailed information on preliminary symptoms and their influence on pain differentiation in cases of sportsman hernia or other conditions causing pain in the groin region.

The aim of this work is to discuss in detail preoperative pain in patients qualified for surgical treatment and determine its nature depending on the type and length of hernia persistence and the patient's age.

Materials and methods

A retrospective analysis was performed on the prospectively gathered data in the National Hernia Repair Register in Poland (KROPP—http://kropp.org.pl). It is an IT tool available for surgeons in Poland that aims to collect detailed data from patients undergoing surgical treatments. Participation in the Register is voluntarily. Answers to over 92 meticulous questions are gathered in the database; hence, participation is mainly dedicated to centers interested in herniology.

The data were collected prospectively from 1647 patients prepared for inguinal hernia repairs in three departments of general surgery within the period of the last seven years (from 1st Nov 2010 to 31st Oct 2017). The data include information regarding patients' age (divided into three groups), sex, occupation type, undertaken sport activities, length of time with the hernia related to the patients' age, occurrence of strangulation/incarceration incidents, hernia size and the facility where the illness was diagnosed. The patients who confirmed the occurrence of preoperative pain determined its intensity using VAS and answered additional questions regarding the nature and circumstances of pain occurrence in detail. The patients described the occurrence of pain during ten everyday activities (Fig. 4.). Fourteen terms describing the nature of pain were presented to the patients, and all patients chose the term that best described the nature of their pain (sensory description, i.e., mild, prickling, pulling, burning, radiating, crushing, penetrating, sharp, etc.). In addition, the patients were presented terms characterizing the emotional character of pain, including six definitions, from which they chose one (irritating, exhausting, dreadful, nauseating, searing, etc.). The patients marked the frequency of pain (very often, often, occasionally, rarely) and its descriptive intensity at rest and while performing physical activities (none, mild, moderate, severe). Demographic details of the patients are presented in Table 1.

Data analysis

All data are presented as the means and percentages. Descriptive statistics were produced for the data set. The parameter variables were analyzed using ANOVA and subgroup analysis using Student's t test. A p value < 0.05 was considered statistically significant.

Results

In 1024 patients (62.2%), hernia appeared less than a year before the study, but in a group of patients younger than 40 years old, only 1 out of 5 patients (20.2%) had hernia longer than 1 year. In patients younger than 50 years old, hernia persisted for approximately 18 months, whereas in patients older than 50, it persisted for 32 months. A total of 789 (47.9%) patients diagnosed hernia on their own, 357 (21.7%) cases were diagnosed by a GP, 401 (24.3%) cases were diagnosed by a surgeon, and 100 (6.1%) cases were diagnosed by another health care professional. The most common symptom upon admission was pain or discomfort in the area of hernia, which occurred in 949 (57.6%) patients at rest and in 1561 (94.8%) patients while performing a physical activity. Hernia was non-reducible in 7.0% of patients. The cumulative probability of non-reducibility increased with time of hernia persistence (from 2.3% in hernias below 12 months to 11.3% above 5 years). A total of 176 (10.7%) patients reported the need to use analgesics due to experienced pain. A total of 303 (18.4%) patients reported pain prior to the appearance of a lump in the groin. Only 115

Table 1 Demographic details of patients ($n = 1647$)

Demographics	*n*	%
Age	57.7 years (17–90)	
Gender		
Male	1517	92.1
Female	130	7.9
BMI	26.2 (17.3–45.9)	
Smoking		
No	970	58.9
Yes	677	41.1
Occupation type		
Sedentary	352	21.4
Moderate manual	254	15.4
Heavy manual	389	23.6
Retired or unemployed	652	39.6
Sport activity		
Recreational	769	46.7
Professional	122	7.4
No	756	45.9
Education		
Elementary	392	23.8
High school	858	52.1
College	397	24.1
Hernia duration (months)	25.4 (1–360)	
Hernia reducible		
Yes	1532	93.0
No	115	7.0
Hernia straining		
Yes	25	1.5
No	1622	98.5
Pre-op hernia size assessment		
Above inguinal ligament	847	51.4
Below inguinal ligament (excluded scrotal)	571	34.7
Scrotal < 5 cm	97	5.9
Scrotal 5–10 cm	114	6.9
Scrotal > 10 cm	18	1.1
Post-op hernia type		
Direct (M1/M2/M3)	537 (206/110/221)	32.6 (12.5/6.7/13.4)
Indirect (L1/L2/L3)	1110 (389/319/402)	67.4 (23.6/19.4/24.4)
Recurrent hernia		
Yes	101	6.1
No	1546	93.9

(7.0%) patients used a hernia belt, but 2/3 of these patients were over 65 years old.

The intensity of pain according to VAS and the frequency of pain occurrence is presented in Figs. 1 and 2. The change in pain intensity depending on the activity performed is shown in Fig. 3. Figure 4 also presents the influence of pain on common everyday activities. The description reflecting sensory and emotional pain experienced by the patients may be found in Figs. 5 and 6.

BMI differences between the group experiencing preoperative pain at rest (BMI 26.1) and patients without pain (BMI 26.2) were not observed ($p = 0.684$).

In the non-smoking group, 54.8% of the patients experienced pain, whereas in the smoking group, pain occurred in 66.9% of the patients. In patients experiencing preoperative pain, its intensity according to VAS amounted to 4.9 for non-smoking patients and to 5.3 for smokers ($p = 0.041$), but due to the sample size its clinical relevance should be evaluated in further research.

An influence of hernia persistence on the frequency of pain occurrence was not observed. In the group of patients who had hernia for less than 12 months, 60.8% of them felt pain; 57.5% patients who had hernia for over a year experienced pain, and 58.3% patients who had hernia for over 5 years. However, a gradual increase in pain intensity was noted in these patient groups. In patients who suffered pain, its intensity amounted to 5.0, 5.3, and 5.4 in patients with hernia for < 1, 1–5, and > 5 years, respectively; however, it was not of statistical significance ($p = 0.068$).

Patients aged younger than 40 years experienced pain more often (63.7%) than patients aged 40–60 years (60%) and patients aged above 60 years (54.3%). Moreover, the intensity of pain was significantly higher in the group of the youngest patients (VAS 5.4) than in the middle-aged group (VAS 4.9; $p = 0.01$) and the oldest group (VAS 4.8; $p = 0.008$). However, these results should be evaluated with caution, before this issue will be confirmed in further studies.

Discussion

Evaluation of pain in the inguinal region may be done on the basis of information collected while taking patients' history and during the examination. The Short Form 36 (SF-36) questionnaire is a helpful tool in assessing quality of life; however, its efficiency is limited in cases of chronic disease evaluation [12]. Due to this fact, in 2008, Heniford offered a new, easy-to-use, reliable tool for evaluating pain in the inguinal region, i.e., the Carolina Comfort Scale. Using this scale, a patient specifies the intensity of pain during eight daily activities, and the scope of questioning concurs with the scope of questions asked of our study group [5].

There are a number of studies claiming that patients with inguinal pain report for surgeries. However, the type of pain fails to be specified. Additionally, attention is paid to the pain but not to its type, frequency of occurrence or intensity. Hence, on the basis of preoperative pain, it is impossible

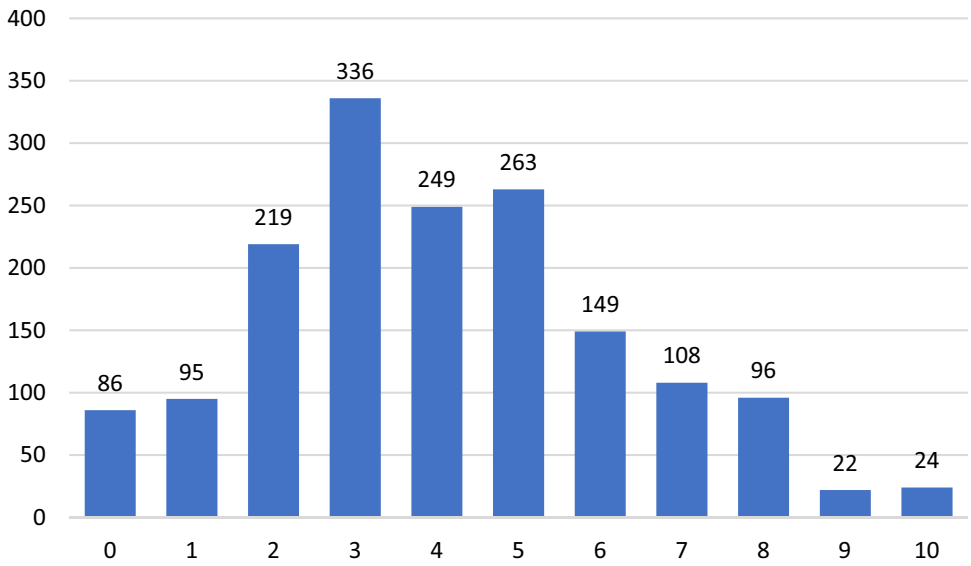

Fig. 1 Evaluation of preoperative pain complaints according to VAS ($n = 1647$)

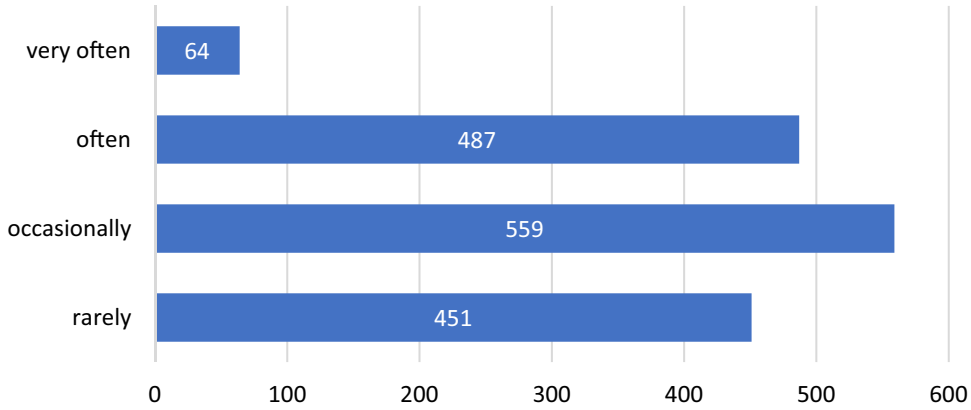

Fig. 2 Frequency of occurrence of inguinal region pain prior to surgery ($n = 1561$)

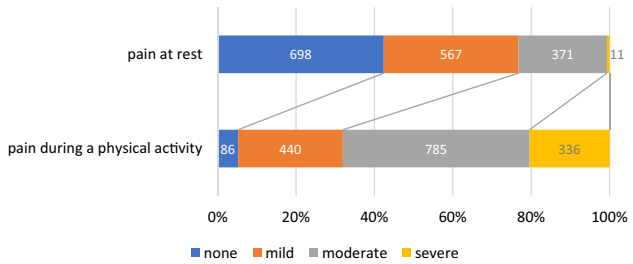

Fig. 3 Changes in intensity while at rest and while performing physical activities ($n = 1647$)

to identify a group of patients who should undergo scheduled surgeries in the first place. Furthermore, it is currently impossible to determine the group of patients who could benefit the most from the conducted surgeries and who may suffer from intensified pain and worsened treatment results due to postponing the surgery or applying the watchful waiting strategy. This impossibility results from the lack of reliable and comprehensive evaluation of preoperative pain in patients with inguinal hernia. In this study, it was ascertained that pain occurred more frequently in the group of patients who suffered from hernia for less than a year. Over time, hernias that have not been repaired caused increasingly more pain. Moreover, postponing hernia repair resulted in an increased number of cases of non-reducibility (from 2.3% below 1 year up to 11.3% above 5 years). Consequently, patients who undergo hernia repair during the first year of its occurrence may feel greater relief; however, this hypothesis should be confirmed in further research. Additionally, greater pain was reported in patients younger than 40 years old. These patients are the most professionally active. Simultaneously, pain caused by hernia was reported to influence professional activities the most (53.8%). Thus, it appears that younger patients with preoperative pain may benefit from hernia repair the most, however, these results need to be confirmed in future studies.

Evaluation of preoperative pain is also necessary in diagnosing the condition and making the decision of whether to perform surgery. According to Niebuhr, despite applied

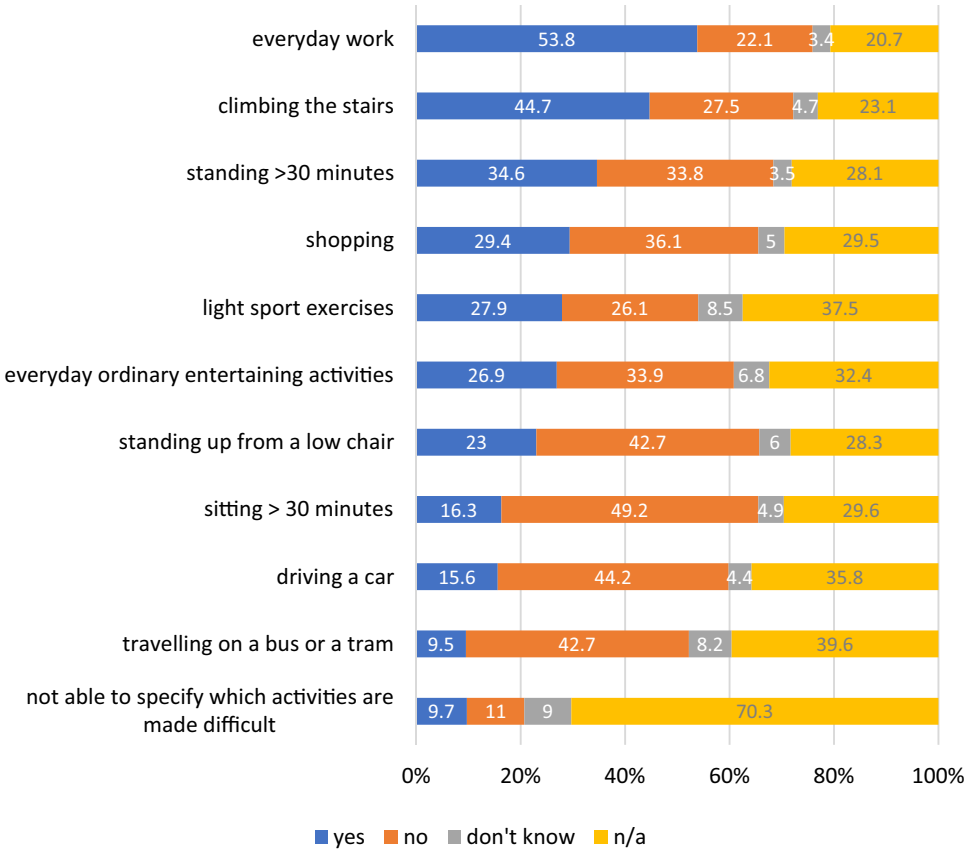

Fig. 4 Percentage of patients reporting the influence of inguinal region pain on performing everyday activities ($n = 1647$)

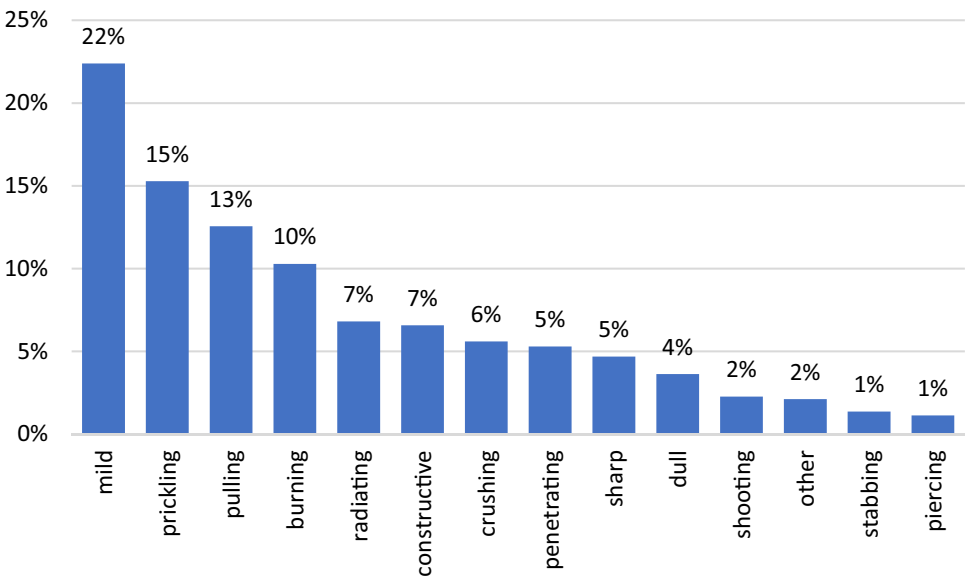

Fig. 5 Sensory description of pain experienced by the patients ($n = 1647$)

clinical and ultrasound examinations, among 19.7% of patients with suspected hernia, it was not possible to confirm the hernia [13]. Very small hernias, which are difficult to diagnose in clinical examinations, are referred to as occult inguinal hernias. In such cases, the only symptom is pain in the inguinal region. However, there are a number of reasons for the occurrence of inguinal pain, and thus, it is important to differentiate between hernial pain and other conditions. Then, it is obligatory to apply diagnostic imaging prior to possible qualification for a surgery. Light et al. reported that despite showing a hernia in an ultrasound in 116 examined patients, it was not observed during the surgery in 31

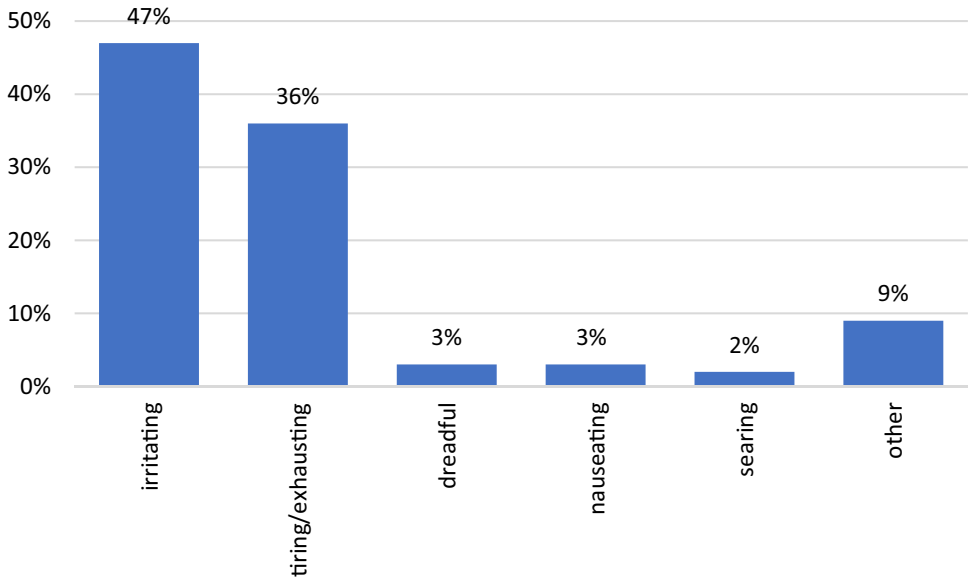

Fig. 6 Emotional description of pain experienced by the patients ($n = 1647$)

cases. In addition, hernia is sometimes observed during a surgery despite not having been observed during both clinical and ultrasound examinations [14]. Hence, the following question arises: what type of preoperative pain reported by a patient should first and foremost make a physician suspect a hernia with a lack of other obvious symptoms in the inguinal region? Having answered it, it will be possible to determine a group of patients whose diagnostics should be supplemented with diagnostic imaging when there are no obvious clinical symptoms. In the analyzed group, as many as half of the patients defined their pain as mild, prickling or pulling, whereas the remaining patients chose one of the other 14 definitions. At the same time, as many as 83% of the patients defined their pain as irritating and tiring (exhausting). The majority of the patients confirmed the occurrence of pain while performing work-related activities (53.8%) or climbing the stairs (44.7%), while other daily activities did not cause discomfort (less than 30%). Further research in a detailed pain assessment prior to surgery may help identify patients with sportsman hernia and select a group of patients who may benefit the most from surgical treatment.

Inguinal hernia usually causes mild to moderate discomfort, which increases while performing physical activities. Persistent severe pain is not characteristic of primary inguinal hernia, as opposed to, e.g., an injury. The *British Medical Journal* Hernia Review in 2008 by Jenkins and O'Dwyer as well as the European Hernia Society Guidelines from 2009 claim that severe pain does not occur commonly [8, 15]. Severe inguinal pain with no incarcerated hernia seldom exists and should make a surgeon consider another source of pain. For this reason, such patients ought to be meticulously examined for the possibility of the existence of another pathology, e.g., groin strain. According to Hair et al., 34% of patients are free from preoperative pain, whereas according to Chung, the number amounts to 30% [4, 9]. Our analysis confirmed that there is no pain at rest in 42% of the patients; however, when they start performing physical activities, the number deceases almost eight times, to 5.2%. Simultaneously, the number of patients reporting strong pain after having undertaken some physical activities increases thirtyfold and concerns every fifth patient. However, the percentage of patients defining preoperative pain as 6 or more VAS points amounts to 24.2%. Every tenth patient reported the need to use analgesics due to experienced pain.

One of the available methods of relieving chronic pain is prophylaxis by means of simultaneous neurectomy during hernia repair. However, the group of patients who would benefit the most from such practice has not yet been identified. It should be noted that prophylactic neurectomy might be considered for patients with severe preoperative pain, most often found in younger patients. However, there are currently no specific guidelines indicating at what pain level neurectomy should be performed [16]. Unfortunately, at the moment a connection between an injury of a nerve in the inguinal region and preoperative pain experienced by a patient is determined after the appearance of postoperative chronic inguinal pain. Then, to identify the involved nerve and differentiate between a neuropathic and nociceptive character of the pain, a sensory mapping test can be performed [7]. Perhaps this test should be performed prior to primary operation in patients who describe their pain as severe before the operation and in those who suffer from pain often or constantly. Our study claims that pain occurs often or very often in as many as 33% of patients. Simultaneously, almost every fifth patient reports moderate to severe pain at rest, whereas while performing a physical activity, the number of patients in this group increases three times (68.1%). Wright et al., who showed changes appearing in

the histologic structure of nerves as a result of entrapment neuropathy in patients with preoperative inguinal pain, confirmed a hypothesis regarding this practice [17].

Based on the confirmed data showing that postoperative pain occurred more often in patients with preoperative pain at rest and that this type of pain can cause entrapment neuropathy over time, the authors suggest decreasing the time between the diagnosis of hernia and planned operation in this group of patients. However, ethically, we do not think that a randomized controlled trial is possible to compare the waiting strategy with a new method of 'semi-acute' indication for treatment, although there is enough data in the literature to compare the newly selected cohort with standard treatment groups from the past.

Conclusions

Preoperative inguinal region pain in patients with inguinal hernia is a common and underestimated phenomenon. While pain at rest is not a significant problem, undertaking physical activities may intensify pain and increase the number of patients suffering from it. Preoperative assessment of pain may help determine the group of patients who could benefit the most from inguinal hernia repair but also the group of patients with other sources of groin pain that are not an inguinal hernia, especially for a patient with no visible or palpable bulge. New indications for prompter admission for treatment should be planned and described in future studies of patients showing pain at rest to avoid postoperative neuropathy. The adequate preoperative assessment of pain intensity, pain characteristics, the relation of pain with different daily activities and impairment in quality of life should be mandatory in all inguinal hernia patients to better identify patients who should go upfront repair or are amenable to watchful waiting. Identifying patients where, even if present, an inguinal hernia is not the cause of their inguinal pain is of utmost importance to improve surgical outcomes and decrease chances of chronic groin pain.

Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interests.

Ethical approval This article does not require ethical approval of any-kind.

Human and animal rights This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent The informed consent was obtained from all individual participants included in the study.

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