

Chronic Pain After Outpatient Inguinal Hernioplasty: Retrospective Cohort Study

Dor Crónica Pós-Hernioplastia Inguinal em Regime de Ambulatório: Estudo de Coorte Retrospectivo



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Acta Med Port 2018 Nov;31(11):624-632 • <https://doi.org/10.20344/amp.9381>

ABSTRACT

Introduction: Chronic postoperative pain is the most frequent late complication of inguinal hernia repair surgery. The aim of this study is to evaluate the incidence of chronic post-hernioplasty pain in outpatient care at Centro Hospitalar do Porto, describe it, analyse its relation with other variables defined in the literature and study its functional interference.

Material and Methods: We performed a retrospective cohort study between February and May 2016, using a structured telephone interview composed of questions from the authors and sections of published questionnaires, two of which are validated for the Portuguese language and culture. We included men who underwent ambulatory inguinal hernioplasty, by laparotomy or laparoscopy, at Centro Hospitalar do Porto, between January 2011 and October 2015.

Results: In a final sample of 829 surgeries, the incidence of chronic post-hernioplasty pain was 24.0% [confidence interval: 21.2 - 27.1]. The development of chronic post-hernioplasty pain was higher in patients with pre-surgical pain and younger age and was related with the presence of pain during the first month after surgery. No relationship was found between surgical technique and the development of chronic post-hernioplasty pain. Of the individuals with chronic pain, 65.0% mentioned moderate-severe 'pain on the average' and 37.7% presented descriptors suggestive of neuropathic pain. The only parameter evaluated with which chronic post-hernioplasty pain 'did not interfere completely' was sleep.

Discussion: The prevalence found for chronic posthernioplasty pain with significant functional interference is in line with data retrieved from literature. The predictive potential of pre-surgical pain and young age for the development of chronic posthernioplasty pain is also in agreement with previous studies. Limitations were found to this study given its retrospective nature.

Conclusion: The high prevalence of chronic post-hernioplasty pain raises the urgent need for raising awareness regarding this issue among health care professionals. The main areas for improvement are diagnosis, follow-up and treatment of pain.

Keywords: Ambulatory Surgical Procedures; Chronic Pain; Hernia, Inguinal/surgery; Herniorrhaphy; Pain, Postoperative

RESUMO

Introdução: A dor crónica pós-cirúrgica é a complicação tardia mais frequente da cirurgia de reparação de hérnia inguinal. Este trabalho visa determinar a incidência de dor crónica pós-hernioplastia inguinal em ambulatório no Centro Hospitalar do Porto, estudar a sua relação com determinadas variáveis descritas na literatura, avaliar as suas características e interferência funcional.

Material e Métodos: Realizámos um estudo de coorte retrospectivo, entre fevereiro e maio de 2016, por entrevista telefónica estruturada composta por perguntas dos autores e secções de três questionários publicados, dois dos quais validados para a língua e cultura portuguesas. Incluímos os homens submetidos a hernioplastia inguinal, por laparotomia ou laparoscopia, em ambulatório, no Centro Hospitalar do Porto, entre janeiro de 2011 e outubro de 2015.

Resultados: Na amostra final de 829 hernioplastias, a incidência de dor crónica pós-hernioplastia foi de 24,0% [intervalo de confiança: 21,2 - 27,1]. O desenvolvimento de dor crónica foi superior nos doentes com dor pré-cirúrgica, nos doentes mais jovens e relacionou-se com o momento de início da dor pós-cirúrgica. Não encontramos relação com a via de abordagem, clássica ou laparoscópica. Dos indivíduos com dor crónica, 65,0% apresentaram dor 'em média' moderada ou forte e 37,7% apresentavam descritores sugestivos de dor de origem neuropática. A dor crónica pós-hernioplastia do ponto de vista funcional apenas 'não interferiu completamente' com o sono.

Discussão: A prevalência encontrada de dor crónica pós-hernioplastia, com interferência funcional importante, é congruente com os dados disponíveis na literatura. O potencial preditor da presença de dor pré-cirúrgica e idade jovem do doente para o desenvolvimento de dor crónica pós-hernioplastia é também corroborado pela literatura. Tratando-se de um estudo de coorte retrospectivo, o estudo apresenta as limitações inerentes.

Conclusão: A elevada prevalência de dor crónica pós-hernioplastia encontrada apontam para a urgência na sensibilização dos profissionais de saúde para esta problemática e otimização do *follow-up*, diagnóstico e tratamento da dor.

Palavras-chave: Dor Crónica; Dor Pós-Operatória; Hérnia Inguinal/cirurgia; Hernioplastia; Procedimentos Cirúrgicos Ambulatórios

INTRODUCTION

Pain is defined by the International Association for the Study of Pain (IASP) as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.¹

Chronic pain (CP) has been defined by Benzon *et al.* as pain that persists past normal healing time and it may present as persistent or recurrent at intervals of months or years and is usually associated with a chronic pathology.²

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Recebido: 30 de junho de 2017 - Aceite: 17 de setembro de 2018 | Copyright © Ordem dos Médicos 2018



Unlike acute pain, it is defined as pain with no biological value and therefore with no benefit to patients.³

The assessment and measurement of pain and particularly chronic pain are challenging tasks, as defining characteristics can vary widely both individually and between patients. In addition, the definition of CP, mainly regarding duration as well as the assessment method and timing can vary widely among different authors.⁴ Therefore, its incidence and prevalence widely variable, making any outcome comparison extremely difficult.⁵ The use of standardized questionnaires validated for the language and culture of the population in analysis is therefore recommended for the external validation of prevalence studies.⁶

It is estimated that one from each five adult European patients presents with CP, which is more prevalent than asthma or diabetes.⁷ However, less than 2% of these patients seek medical attention at a chronic pain unit,⁸ while the remaining patients usually seek primary care units.⁹

In Portugal, studies on CP are still scarce, mainly in the area of chronic post-surgical pain (CPSP). A 36.7% prevalence of CP and a 6% prevalence of CPSP have been estimated in the Portuguese population between Jan 2007 and March 2008 by the study Epidemiology of Chronic Pain.¹⁰

The first study aimed at the identification of trauma and surgery as major risk factors of CP was published in 1998. In this study by Crombie *et al.*, 40% of the 5,130 patients with CP in 10 clinics in the United Kingdom presented with pain upon surgery or a trauma episode. Surgery as second cause of CP (22.5%) was only overcome by the presence of degenerative disorders (34.2%). These were the conclusions, among others, that have led to an increasing interest in CPSP.¹¹

One of the highest rates of CPSP is associated with hernia repair, together with mastectomy, thoracotomy, major abdominal surgery, lumbar surgery and limb amputation.¹²

A total of 2,800/1,000,000 patients are annually submitted to hernia repair in Europe and in the United States¹³ and a 27% estimated risk in male and 3% in female of the need for hernia repair have been found in the general population of industrialised countries.¹⁴

Hernia repair surgery is mostly successful, followed by some weeks of recovery,¹⁵ involving few postoperative complications and long-term complications are rare. Nevertheless, considering the high number of patients who undergo a hernia repair (HR), any long-term complication, although rare, may have a significant economic, social, physical and emotional impact.¹² Rates of chronic pain following HR ranging from 0 to 54% have been described in prevalence studies.⁶

According with Loos *et al.*, some degree of functional disability has been described by around 21% of the patients with chronic pain following HR.¹⁶ Courtney *et al.* have described its negative impact on activities such as walking and standing for short periods, its relevant association with sleep disorders and the interference on the ability of maintaining social relations.¹⁷

The emergence of tension-free techniques, the discov-

ery of synthetic materials and the introduction of minimally invasive techniques have produced a radical change in the paradigm of hernia repair surgery throughout the past decade,^{3,18,19} with an improvement in the index of quality of the procedure and a significant reduction in the recurrence rate (1% - 5%).²⁰ Chronic pain following HR has been recognized as the leading postoperative complication¹² and involving the most difficult approach.³

Regardless of the approach, dissection, the use of foreign material and inflammation are involved in hernia repair surgery, in addition to tissue injury and eventually to nerve damage. The presence of nociceptive and neuropathic pain, with hyperalgesia, spontaneous pain, paraesthesia and mechanical allodynia or induced by thermal changes can subsequently occur.²¹ Recently, with the use of more than 160 types of prosthetic materials available on the market,²² an extended postoperative inflammatory response has been found.^{8,23} Therefore, even though CP has been defined by the IASP as the presence of pain for no less than three months,¹ chronic pain following HR is considered as the presence of pain for no less than six months.^{23,24} This definition seems in line with the studies showing a decline in the incidence of pain during the first six postoperative months. Nevertheless, other causes of pain must be ruled out, particularly pain associated with any preoperative condition.²⁵

The assessment of the incidence of chronic pain (CP) following outpatient hernia repair (HR) with the application of prosthesis, by laparotomy and laparoscopy, in male patients was the study's primary endpoint.

The determination of whether the development of CP following HR correlates with the following variables - presence of preoperative pain, previous abdominopelvic surgery, type of surgical approach, uni or bilateral repair and onset of postoperative pain- was the secondary endpoint, in addition to the characterisation of chronic pain following HR and its functional interference, seeking of medical attention and the use of a tailored treatment approach.

MATERIAL AND METHODS

This was a retrospective cross-sectional study that took place between Feb and May 2016 at the *Centro Hospitalar do Porto* (CHP) and was validated by the *Departamento de Ensino, Formação e Investigação* as well as by the Ethics Committee of the CHP.

A total of 1,392 male patients have been considered and eligible and were included in the study (corresponding to 1,428 surgery procedures) and the following inclusion criteria were considered: patients over the age of 18 admitted to the Outpatient Surgery Clinic of the CHP and submitted to hernia repair with the application of a prosthesis, uni or bilaterally, by laparoscopy or laparotomy (outpatient surgery), between Jan 2011 and Oct 2015.

Patients with a history of previous ipsilateral HR were not eligible for inclusion in the study.

Previous to data collection, a study presentation and participation acceptance letter was sent to the selected

patients and participants were subsequently contacted by phone within a structured interview.

Interviews took place in April and May 2016 and those who did not answer the phone or rang up were contacted four times, at least twice through an identified phone number at different times and days. According to the established criteria, failure to contact with a participant led to the exclusion from the study.

Data regarding variables to be analysed were obtained from responses to the telephone questionnaire. No data was obtained from patient's electronic medical record.

Data regarding the presence and duration of preoperative pain, onset of post-surgical pain (immediate, over the first month, over the two following months or subsequently) as well as data regarding CPSP duration and location were obtained from responses to items 1 to 2.1 designed by the authors (not based on any validated questionnaire) (Appendix 1: https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/9381/Apendice_01.pdf).

Data regarding variables on the characteristics of pain frequency, seeking of medical attention and tailored treatment were obtained from items 3 to 5 of the questionnaire, based and adapted to the Portuguese language from the structured in-depth-interview questionnaire⁸ (non-validated questionnaire).

Data regarding pain intensity assessment (as mean, maximum pain and score at the time of the interview), type of treatment, pain relief rate and pain-related functional interference were obtained from items 6-8 and 11-14 of the questionnaire, based on the *Inventário Resumido da Dor* (Brief Pain Inventory – BPI), validated version for the Portuguese language and culture.²⁶

Data on the presence and quantification of descriptors of neuropathic pain were obtained from items 9 and 10 of the questionnaire, taken from the *questionário específico para rastreio de dor neuropática – DN4* – section *questionário do doente*²⁷, validated version for the Portuguese language and culture.^{26,27}

The presence of pain more than once a week⁸ over a period of no less than six months¹ was considered as CP following HR for data analysis and outcome discussion.

The point prevalence of CP following HR has been calculated from the frequency described on the week before the interview.

The presence of at least three descriptors associated with neuropathic pain suggested the presence of pain with a probable neuropathic origin.²⁷

Pain intensity was assessed by using a 11-point numerical scale, in which 0 was associated with 'absence of pain', 1-3 with 'mild pain', 4-6 with 'moderate pain' and 7-10 with 'severe pain'.²⁸ Current pain intensity regarded the presence of pain at the moment of the interview. Functional interference of CP following HR was assessed on a 0-10 range and scored as 'no interference' (0), 'mild interference' (1 - 3), 'moderate interference' (4 - 6), 'high interference' (7 - 9) and 'absolute interference' (10).²⁶

Bilateral surgery (performed at the same operative session) was considered as a single surgery, corresponding to a single questionnaire. Patients who were operated to each side at different operative sessions, with no previous ipsilateral surgery, were surveyed regarding each surgery in isolation and each patient has responded to two questionnaires, one per each surgery.

Continuous variables were expressed as mean \pm standard deviation and compared by using Student's t-test. Categorical variables were presented as distributions of frequency and compared by using chi-square test. The association of CP following HR with patient's age was analysed as a general linear model.

IBM SPSS Statistics software version 22.0.0 has been used. The accuracy of the prevalence rates was delivered by 95% confidence intervals (95% CI).^{29,30}

RESULTS

Valid responses to the questionnaire were obtained from 818 patients (from the 1,392 eligible and digitally selected patients), corresponding to 829 hernia repair surgeries. A total of 599 hernia repairs were excluded from the study, as shown in Fig. 1.

Mean age of the participants was 55.5 ± 13.1 years (range 23-86). The distribution of our group of patients by age ranks and by the year when surgery was performed is shown in Table 1.

A 24.0% rate of surgeries leading to the presence of CP following HR has been found [21.2 – 27.1], increasing to 35.2% when only 'duration of more than six months' criterion was considered and 'more than once a week' was excluded. A 16.8% point prevalence of CP following HR has been found [14.3 – 19.5].

Mean age of patients with CP following HR was lower than those with no CP following HR ($p = 0.003$).

A percentage of 29.5% of the patients with preoperative pain have developed CP following HR, compared to 12% of those with no preoperative pain having developed CP following HR ($p < 0.001$).

No association has been found between CP following HR and (i) uni or bilateral surgery, (ii) type of surgery (Table 2, Fig. 2) and (iii) history of previous abdominopelvic surgery (Table 2).

An association between the development of CP following HR and the onset of pain has been found ($p < 0.001$): CP following HR was presented by 43.2% of the patients immediately after surgery, by 71.9% of the patients during the first postoperative month (excluding the presence of pain immediately after surgery), by 45.6% of the patients on the three months following surgery (excluding the first month) and by 35.8% of the patients more than three months after surgery.

The distribution by pain intensity ranks – usual, maximum and current is shown in Fig. 3. A percentage of 68.0% of the patients with CP following HR have presented with pain at the moment of the telephone interview (current pain).

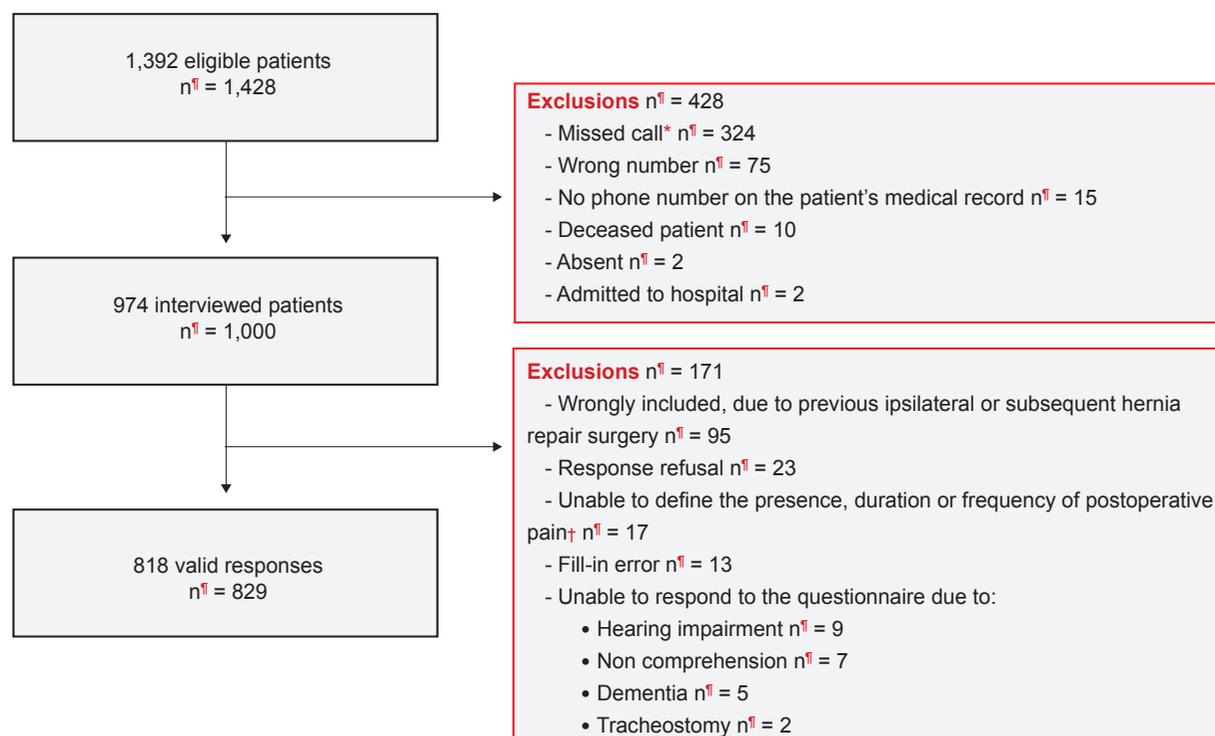


Figure 1 – Flowchart of the selection procedure

n[†] - number of surgical procedures (the same patient may have undergone two non-ipsilateral hernia repair surgeries).

* - four failed attempts of telephone contact, two of which using an identified phone number, out of the working hours and in different days.

† - 'Do not know / do not remember' response to items 2.1, 3.1 or 4.1 (Appendix 1)

Table 1 – Distribution of the patients with chronic pain following hernia repair (CP following HR) and with current CP following HR (described during the week before) by age group and year of surgery

	Total (n = 829)		With CP following HR			With current CP following HR		
	n	n	%	95% CI	n	%	95% CI	
Age								
< 35	59	16	27.1	16.8 - 40.5	8	13.6	6.5 - 25.5	
35 - 44	104	34	32.7	24.0 - 42.7	30	28.8	20.6 - 38.69	
45 - 54	215	61	28.4	22.5 - 35.0	61	28.4	22.5 - 35.0	
55 - 64	238	49	20.6	15.6 - 26.4	37	15.5	11.3 - 20.9	
65 - 74	158	30	19.0	13.4 - 26.2	27	17.1	11.8 - 24.1	
≥ 75	55	9	16.4	8.2 - 29.3	9	16.4	8.2 - 29.3	
Year of surgery								
2011	138	21	15.2	9.9 - 22.6	14	10.1	5.9 - 16.7	
2012	148	24	16.2	10.9 - 23.4	24	16.2	10.9 - 23.4	
2013	179	37	20.7	15.1 - 27.5	34	19.0	13.7 - 25.7	
2014	178	51	28.7	22.3 - 36.0	40	22.5	16.7 - 29.5	
2015	185	66	35.7	28.9 - 43.1	60	32.4	25.9 - 39.8	

CP following HR: chronic pain following hernia repair; CI: confidence interval

As regards functional interference (Fig. 4), absolute interference of CP following HR was only found with patient's sleep.

Descriptors suggesting the presence of a probable neuropathic origin were found in 37.7% of the patients with CP following HR, mostly stinging sensation (65.8%), followed by numbness (43.2%), tingling (36.7%), 'electric shock' (28.1%), itching (18.1%), burning (17.1%) and painful cold

(6.5%).

A total of 72 (36.5%) from the 197 patients who responded to 'Have you ever sought the advice of a physician due to that pain?' item have responded positively, while 33 (17.6%) from the 188 patients who responded to 'Have you followed any treatment of medication due to that pain?' item have responded positively, 18 from which have specified the type of treatment: non-steroidal anti-inflammatory drugs (n = 10),

acetaminophen (n = 5), tramadol (n = 2), gabapentin (n = 1) and corticosteroids (n = 1); two patients were treated with more than one drug. Physiotherapy (n = 1) and the use of an abdominal elastic band (n = 1) have also been described.

No relief was described by five (16.7%) from the 30 patients having followed a treatment and who were able to assign a pain-relief rate, partial relief by 20 (66.7%) (30 to 90% relief) and total by 5 (16.7%).

DISCUSSION

A 24.0% rate of patients having developed CP following HR has been found, increasing to 35.2% when 'more than once a week' variable was removed (for comparison), corresponding to around one from each three men, in line with literature.⁶ The presence of pain after elective inguinal her-

nia repair was found in 39.4% of the 227 patients (only three female) by Manangi *et al.* in a prospective study (patients were available for follow-up at six months), which is slightly above the present study's rate.³¹

Immediate postoperative pain, together with severe preoperative pain, were usually considered in literature as potential predictors for the development of CP following HR.³⁴

The development of CP following HR in 29.5% of the patients with preoperative pain (vs. 12.0% of the patients with no preoperative pain having developed CP following HR) gives support to the hypothesis considered by Althaus *et al.*, Demetrashvili *et al.* and Manangi *et al.* on the predictive potential of this variable to the development of CPSP.³¹⁻³³

According to our results, the development of pain during the first postoperative month also seems to predispose to

Table 2 – Characteristics of the total sample and the groups of patients with or without CP following HR

	Total (n = 829)	With CP following HR (n = 199)	Without CP following HR (n = 630)	p-value ¹
Age, mean ± standard deviation	55.5 ± 13.1	53.1 ± 12.7	56.3 ± 13.2	0.003
Uni or bilateral surgery				
Unilateral, n (%)	672 (81.1)	160 (80.4)	512 (81.3)	0.785
Bilateral, n (%)	157 (18.9)	39 (19.6)	118 (18.7)	
Surgical approach				
Open surgery, n (%)	773 (93.2)	188 (94.5)	585 (92.9)	0.429
Laparoscopy, n (%)	56 (6.8)	11 (5.5)	45 (6.8)	
Preoperative pain				
Present, n (%)	570 (68.8)	168 (84.4)	402 (63.8)	<0.001
Absent, n (%)	259 (31.2)	31 (15.6)	228 (36.2)	
Previous abdominopelvic surgery	(n = 768)	(n = 182)	(n = 586)	
Yes, n (%)	262 (34.1)	58 (31.9)	204 (34.8)	0.464
No, n (%)	506 (65.9)	124 (68.1)	382 (65.2)	

CP following HR: chronic pain following hernia repair

¹ For all the variables that were described, p-value refers to the comparison between both groups (with or without CP following HR). Student's t-test was applied to the 'Patient's age' variable; chi-square test was applied to the remaining variables.

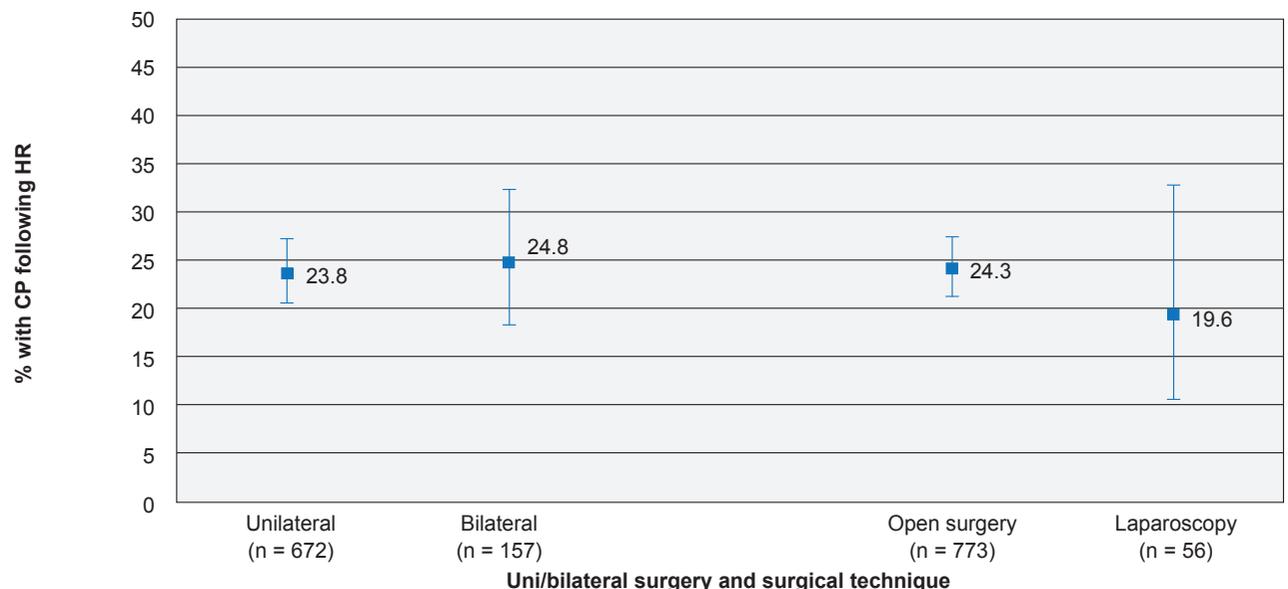


Figure 2 – Rate of chronic pain following hernia repair per uni or bilateral surgery and per type of surgical approach (chi-square test, $p = 0.785$ and $p = 0.429$, respectively)

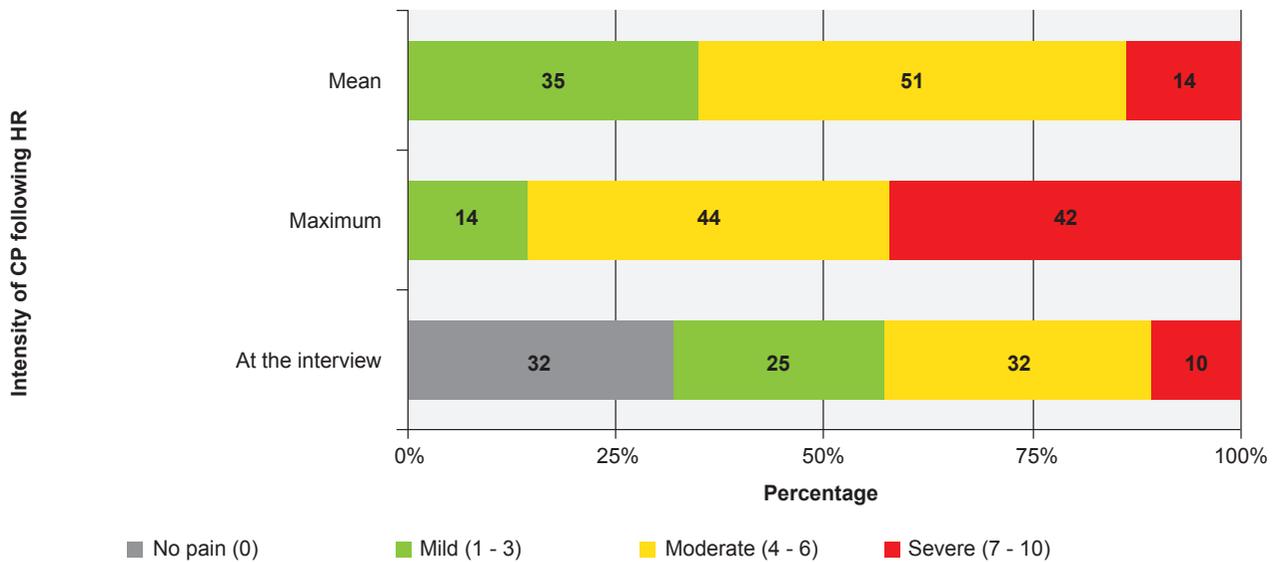


Figure 3 – Distribution per classes of intensity of CP following HR (as mean, maximum pain and at the interview) (n = 197)

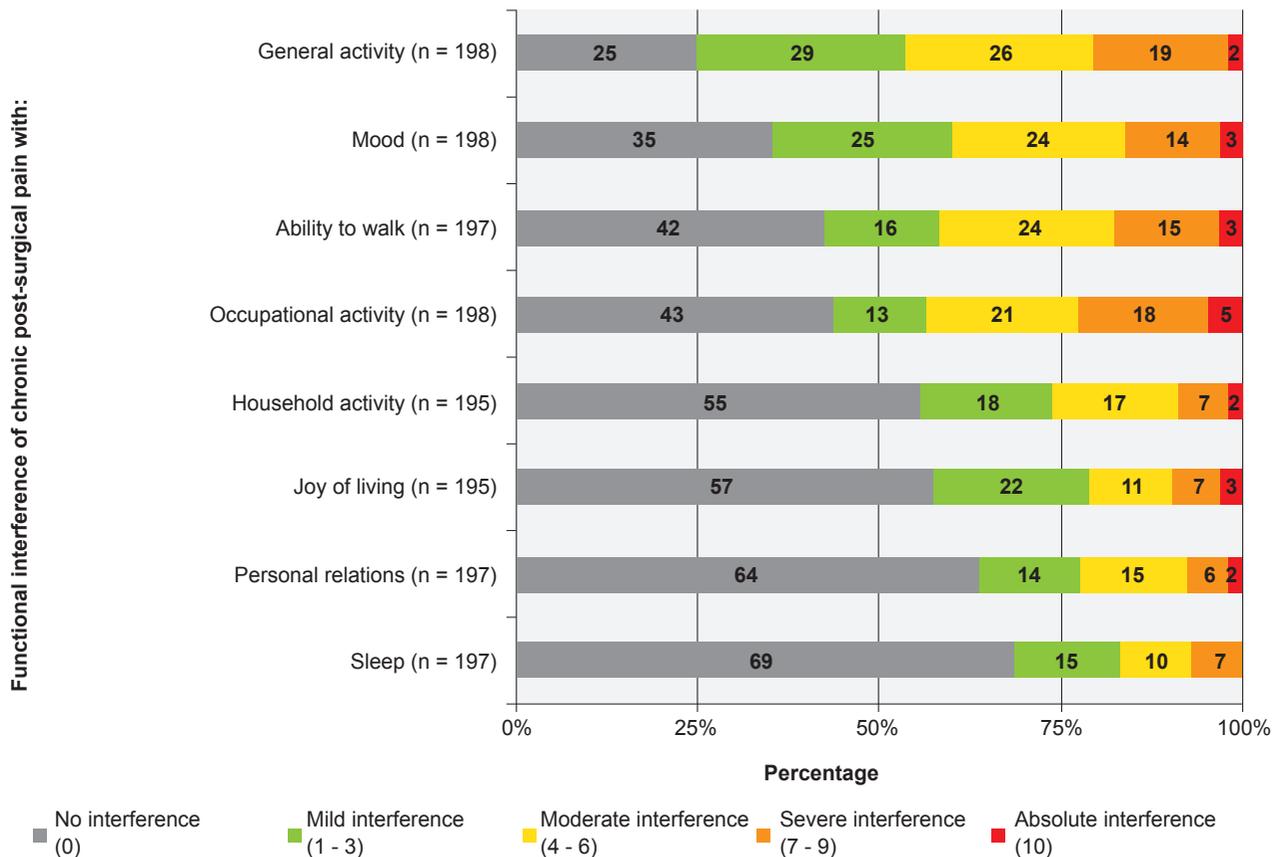


Figure 4 – Distribution per classes of the functional interference of CP following HR

the development of CP following HR (71.9%), suggesting the need for a more frequent follow-up protocol on the first postoperative months, with timing established according to the results of each department.³³

A multifactorial aetiology for CP following HR is usually considered, with relevant overlapping nociceptive and neuropathic components of pain,¹² which is confirmed by the re-

sults of the last multi-centric observational study on CPSP in Europe.³⁵ In our study, 37.7% of the patients with CP following HR have presented with descriptors suggesting neuropathic pain. Patient's medical history, physical examination with neurologic examination and the use of ancillary tests would be needed for the diagnostic confirmation, which are not feasible within a retrospective study.³⁶ Patients present-

ing with pain with an intensity ≥ 30 (analogic visual scale) at the moment of an interview were selected by Loos *et al.* from a group of patients submitted to elective HR between Jan 2000 and Aug 2005 and almost half (46.5%) of the 148 patients who have met the protocol of physical examination and therapeutic test seemed to present with neuropathic pain.³⁷

An evidence regarding a correlation between patient's functional disability and neuropathic pain as well as the intensity of CPSP has been suggested by literature.³⁵ A 65.0% percentage of patients usually presenting with moderate or severe CP following HR has been found in our study, increasing to 85.1% when the maximum pain ever experienced has been considered. A 50% prevalence of moderate-severe pain with a duration of no less than three months has been found in a descriptive study with a group of 77 patients by Rehman *et al.*¹⁸ In contrast to these conclusions, a higher prevalence of mild pain when compared to the sum of moderate and severe pain has been found in the study by Manangi *et al.*³¹ The use of different scales and the lack of consensus between the different authors regarding the definition of chronic pain is worth mentioning and could have biased the outcome comparison.

A lower mean age of patients in the group of those with CP following HR has been found, when compared to the group of patients with no CP following HR, with a reduction in the prevalence of CP following HR with the patient's age. Langeveld *et al.*, based on a prospective study and with a follow-up time extended to 12 months, have also reached the conclusion that the younger the patient, the higher the risk of developing CP following HR. An increase in comorbidities and higher tolerance to pain, as well as the reduction in peripheral nociceptive sensitivity³⁸ and in the level of physical activity in the older population²³ have been referred as potential explanations for the differences found between both age groups. In contrast, Donati *et al.* have reached the conclusion that patient's age had no influence on the development of pain with a duration of no less than six months. However, a larger percentage of symptoms ranked as minor among which a "feeling of discomfort" (not included as a strict definition of pain) have been found in the group of patients aged under 65.³⁹

We have reached the conclusion that patients face a higher level of disability regarding their general activity, the disposition and ability to walk, when compared to other variables, in line with Courtney *et al.* Nevertheless, severe and absolute interference was mostly found with patient's labour activity.¹⁷

No association has been found between CP following HR and the surgical approach (open *versus* laparoscopic surgery). In contrast, the conclusion that the development of chronic pain or discomfort seems more frequent in patients who were submitted to open surgery was found in a literature review by Aasvang *et al.* and a retrospective study by Kumar *et al.*^{23,40} Loos *et al.* have also found that 1% of patients with chronic pain submitted to open surgery in their study group were referred to the chronic pain outpatient

department, in comparison with 0.4% of the patients who underwent laparoscopic surgery.³⁷ However, despite all the different studies comparing these techniques, considering all the specificities, no clear benefit has been found with any of the techniques.²⁰

In our study, the percentage of patients seeking for medical advice (36.5% of 197 patients) seems inappropriate considering the high prevalence of moderate-severe pain. Since only 18 patients were able to specify their treatment, any discussion on the adequacy of therapy seems misplaced. However, considering the possible presence of a neuropathic component in 37.7% of the patients, the description of other drug classes, such as secondary amines (tricyclic antidepressants), serotonin-norepinephrine reuptake inhibitors (SNRI), other GABA (gamma-aminobutyric acid) analogues and other opioid analgesics, would be expected.⁴¹

The assessment of the effect of the following variables - anaesthetic technique,⁴² preventive analgesia, adequate postoperative analgesia,³¹ surgical technique and experience of the surgical team, type of prosthesis¹² and signs of a nerve injury,²³ in the incidence and characteristics of CP following HR, described as potential confounding factors and potentially related to limitations of the study, was not the aim of the study.

There may exist an information bias regarding the records, as this was a retrospective, cross-sectional study, based on a telephone interview and therefore exclusively based on the participant's memory. In addition, the patient's education, economic level and occupational situation (non-assessed parameters) may have interfered with the pain perception by patients and have biased the results.

The development of CP following HR was assessed in a group of patients who underwent HR surgery between 2011 and 2015 and the presence of different periods of risk is worth mentioning - the patients who were operated in 2011 were approximately exposed for five years to the risk for CP following HR while those operated in 2015 were only exposed for one year, therefore with a higher probability for the development of CP following HR upon the interview, when compared to the former. Therefore, the point prevalence in our group of patients was only referred to the presence of pain at the time of the interview (developed over the previous week).

Finally, a single validated questionnaire was not used for the telephone interview, rather a compilation of two validated questionnaires for the Portuguese language and culture and one non-validated questionnaire, in order to comply with the study aims.

Mostly Caucasian and only male patients were included in the study, which may prevent from any extrapolation of the results to similar groups of patients or to other ethnicity and gender.

CONCLUSION

A 24.0% incidence of CP following HR has been found in the study and its presence was associated with a relevant

functional interference. Young age, the presence of preoperative pain and pain over the first postoperative month were associated with the development of CP following HR. More than one third of the patients met criteria suggesting the presence of neuropathic pain. In conclusion, the percentage of patients seeking medical advice or having been submitted to treatment seems inadequate. The surgical approach did not show any correlation with the presence of CP following HR.

An action against under-diagnosis, under-treatment and an inadequate treatment of these patients is therefore crucial and an optimization of the follow-up of the patients submitted to hernia repair must be considered, aimed at the diagnosis and treatment of post-surgical pain and referral of patients, when needed, to a chronic pain clinic. An improved awareness of healthcare professionals, including surgeons, anaesthesiologists and general practitioners is therefore extremely important.

ACKNOWLEDGMENTS

The authors wish to acknowledge Bruno Rocha at the Department of Information and Management of the Centro Hospitalar do Porto, Carlos Magalhães for his careful rec-

ommendations and references, Maria de Sameiro Pereira for the study's revision as well as Rui Magalhães and Carolina Lemos for their endless support to the statistical analysis.

HUMAN AND ANIMAL PROTECTION

The authors declare that the study was validated by the Department of Education, Training and Research and the Ethics Committee of the *Centro Hospitalar do Porto* and according to the Helsinki Declaration of the World Medical Association.

DATA CONFIDENTIALITY

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest in writing this manuscript.

FINANCIAL SUPPORT

The authors declare that there was no financial support in writing this manuscript.

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