

## Chronic Post-Surgical Pain (CPSP) In Patients with No Pre- Surgery Pain or Pain History

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### ABSTRACT

*The aim of this study was to examine CPSP rate in patients with no pre-surgery pain or pain history, following two types of surgical procedures. It focused on pain treatment during and after surgery and the consequences of early discharge on the patient's coping with self-treatment and use of community health services. The descriptive research was approved by the local Helsinki Commission (0150-09-KMC), and included a sample of 71 patients of genders, aged 25-67, undergoing open inguinal hernia repair or laparoscopic cholecystectomy under general anesthesia. The patients were discharged one day after the procedure, signing an informed consent form to participate in the study. Data was collected from medical records and a telephone interview conducted 3 months post-surgery. The results indicated low use of health services and 0% of CPSP in patients who had surgery for the first time, with no disease history involving chronic pain. Conclusion: In patients undergoing hernia repair and cholecystectomy with no history of disease causing chronic pain, receiving adequate pain treatment during and following surgery, CPSP did not develop. Taking pain medication following discharge was the only factor affecting the number of pain days and reducing risk of CPSP.*

**Perspective:** *This study examined the incidence of CPSP in patients undergoing their first surgery, with no pre-surgery pain or disease history involving chronic pain. Also investigated was the impact of discharge after one day on the patient's coping with self-treatment? Participants were interviewed three months post-surgery, and no incidence of CPSP was found.*

### Keywords

Chronic pain, Postoperative, Postsurgical, Analgesia, Pain control, Health service utilization, Discharge training.

### Introduction

The first publication that identified surgery as a risk factor for Chronic Post-Surgical Pain (CPSP) appeared in 1998, and was defined as constant pain lasting more than two months after surgery [1,2].

Recently a new definition is suggested including four elements necessary for defining CPSP: pain develops following surgery, lasts at least two consecutive months, the patient has no chronic

pain from another source, and the patient did not suffer from pain prior to surgery [3]. CPSP is a recognized phenomenon, considered a complication of surgery. One-third of patients report constant or intermittent pain a year after surgery [4-7]. CPSP affects quality of life, with a marked increase in the need for health services and high economic costs. It is a medical, economic, social, and personal problem of the highest degree [8,9].

Each year, more than 4 million people in England undergo surgery, and therefore the problem of CPSP is of high personal and economic significance [10]. CPSP incidence is common in procedures such as hernia repair, limb amputation, joint replacements and thoracic surgery, ranging from 10-50% according to the type of surgery [11-

13]. The reasons for the emergence of CPSP are inconclusive, but predictor variables found for CPSP development are age, female gender, psychosocial factors, history of pre-surgery pain, previous surgeries, pain intensity during the postoperative period, and postoperative complications. It is customary to divide risk factors into preoperative, surgical, and postoperative factors. Patient age was significant, as age increases, so does the risk of developing CPSP [1,10,14]. Females suffer from pain at a significantly higher incidence and intensity than males and studies have shown that women have higher rates of CPSP [8,1]. Pre-surgical pain, its duration and intensity prior to hernia surgery, amputation and mastectomy was associated with CPSP development [10]. Also, there is possibly a genetic predisposition to develop CPSP [10,15]. Inflammatory pain, such as following hernia surgery using mesh, is considered a risk factor [10], as is pain caused by nerve damage [8,10]. Additional factors that may have an effect are length of surgery, complications during surgery [16] and method of surgery. Gallbladder and hernia surgery using laparoscopy have a lower incidence of CPSP compared to open surgery [12]. Surgical incision size, experience of the surgeon, regional anesthesia or administering preemptive analgesia was found to have no correlation to CPSP development [13].

However, it was found that providing pain medications during and after surgery inhibits the central sensitization and reduces CPSP incidence, such as giving a local anesthetic when beginning and concluding surgery, or epidural during and following surgery [10]. Theoretically, reducing nociceptive fiber activity during surgery prevents central sensitization and reduces postoperative pain and CPSP [13]. Postoperative pain is found to have a constant correlation with CPSP in many studies [6,9,10,12,13,17-20]. But even with good perioperative analgesia, the trend of shortening hospitalization leads to the discharge of patients in pain, the day of surgery or the following day. From discharge, the patient and family are responsible for relieving pain and all other aspects of treatment. Without proper guidance, this may have implications from inefficient to harmful care, high cost re-hospitalizations, or referrals to emergency or clinics. Involvement in discharge and providing training reduces these problems and enables the patient to handle continuous self-care, and increases patient satisfaction [21,22]. The aim of this study was to counteract factors that may influence CPSP development and to examine the effect of pain medication during and after surgical procedures on CPSP.

## Method

### Type of study

The present study is a descriptive study that examined the degree of development of CPSP and its consequences after surgical intervention, patients dealing with pain self-treatment, and their use of health services. The study received the approval of the local Helsinki Commission. (KMC-0150-09) The research was conducted at Kaplan Medical Center, Rehovot, Israel.

### Sample

The sample included 71 patients aged 25-67 hospitalized in the surgery department, who underwent elective surgical procedures

and signed informed consent forms to participate in the study. Participation in the study was offered to all patients who met the criteria for inclusion. The offer was made upon their discharge, a day following their surgery.

### Criteria for inclusion

Patients aged 25-67 of either sex, undergoing their first surgical procedure for open inguinal hernia repair or laparoscopic cholecystectomy. The patients were discharged home. The postoperative course was normal, without complications or infections, and the patients agreed to answer a telephone questionnaire.

### Criteria for exclusion

Oncology patients, patients with chronic pain due to disease history (neuropathic pain, back pain, diabetes, osteoarthritis, etc.), patients with pain pre-surgery (patients with pain at rest), patients suffering from mental health problems, patients using alcohol or drugs, patients requiring emergency surgery, patients with infection or other complications after surgery.

### Data Collection

Medical records and a telephone interview conducted 3 months after the surgery. The data collection was carried out during 2010-2014.

### Tools

For the study, two reliable and validated tools were prepared; there was no need to use the second tool.

A questionnaire covering demographic information, coping, and use of health services. The questionnaire was based on a similar questionnaire in English, it was translated and passed an internal reliability test [22].

Brief Pain Inventory Short Form (BPI). The short form was translated into Hebrew by the double translation method by Professor Pesach Shvartzman and was found reliable.

### Statistical Analysis

Carried out with the SPSS software. The process checked distributions, differences between t - test groups and between departments, and correlations between variables.

## Results

75 participants agreed to participate and signed a consent form, 4 patients were excluded due to failure to meet the criteria for inclusion. 71 participants responded to the telephone survey 3 months after surgery.

Patient recruitment and data collection was carried out during 2010-2014. The study included 71 patients of both sexes aged 25-67, who underwent their first (elective) surgery, under general anesthesia, and were discharged directly home a day after surgery, after the surgery and the postoperative period were determined to be normal, without complications or infections.

The study included 39 patients (55%) following lap. cholecystectomy and 32 patients (45.07%) following open inguinal hernia repair in the surgical departments of the hospital.

All patients underwent surgery under general anesthesia, and to control the amount of analgesia in each treatment site, the medication was converted to pharmaceutical morphine standard.

Total opioids in the operating room indicated that there were no statistical differences in the amount of opioids used in the two surgical procedures. ( $p=0.287$ ). Cholecystectomy patients received an average of 24.74 mg and hernia patients received an average of 22.91mg (Table 1).

Test	Open Inguinal Hernia	Laparoscopic Cholecystectomy	
<b>p in t test</b>	32	39	N
<b>0.287</b>	22.91	24.74	Average
	8.29	6.13	Standard Deviation
	20	25	Median
	10	10	Minimum
	40	40	Maximum

**Table 1:** Analysis of differences in averages of quantities of opioids in two types of surgeries in the operating room.

Also in recovery room, no statistical differences were found between the amounts of opioids in the two types of surgery. Cholecystectomy patients received an average of 5.52 mg and hernia patients received an average of 5.40 mg ( $P= 0.905$ ).

63.4% of patients (45) were administered another medication besides opioids. 36.6% of patients (26) received no additional medication besides opioids.

#### Level of pain on arrival in surgical ward

60.6% of patients (43) arrived in the department approximately 2 hours after surgery, with no pain at all. 66.7% of cholecystectomy patients and 53.1% of hernia patients reported a negligible degree of pain. 26.8% (19) reported a mild degree of pain when arriving in the department, 12.6% (9) reported a moderate level of pain. No patients reported a pain level higher than 6.

No statistical differences were found ( $p=0.196$ ) in pain levels upon arrival in the department. The average level of pain following cholecystectomy upon arrival in the department was 0.97, and the average level of pain following hernia repair was 1.50. Overall average was 1.21.

There was no correlation found between amounts of opioids received by the patients during and following surgery and the level of pain in the department 2 hours after surgery. The Pearson correlation coefficient indicated no difference ( $-0.07$ ).

#### Pain medication in surgical ward

The average amount of opioids received by patients in the department during hospitalization (from arrival to discharge the

next midday) was 11.03 mg. Cholecystectomy patients received an average of 11.64 mg and hernia patients received an average of 10.28 mg. The maximum amount received by a cholecystectomy patient was 50 mg, and the maximum amount received by a hernia patient was 30 mg. There were no statistical differences between the procedures. ( $p=0.518$ ). The majority of patients received multimodal treatment following surgery (67.6%) 32.4% received only one medication.

#### Pre-discharge intervention

The majority of patients - 58 (81.7%) - reported that they received instruction at discharge on continuing pain treatment and the minority did not remember/did not receive instruction. The vast majority of patients reported high or very high satisfaction. There were no statistical differences in satisfaction between the two wards ( $p= 0.590$ ).

Recommendations for continuation of treatment and prescriptions 62.9% of patients (44) received written recommendations for continuation of treatment together with prescriptions. 37.1% of patients (26) received no recommendations for continuation of treatment.

44.3% of patients (31) received recommendations for multimodal treatment. 56.3% of hernia patients received these recommendations, as opposed to 34.2% of cholecystectomy patients. There was no statistical difference between procedures/departments. 55.7% of patients (39) received recommendations for continuation of treatment but the recommendations did not include multimodal treatment. 43.8% of hernia patients (14) did not receive the desired recommendations.

#### Pain on day of discharge

The majority of patients - 47 (66.2%) - reported pain on discharge. 18 (46.2%) of them underwent laparoscopic cholecystectomy and 29 (90.6%) following open inguinal hernia repair patients.

#### Number of pain days following surgery

There was a statistical difference in pain days found between the procedures. ( $p=0.005$ ) 65.6% of hernia patients (21) reported pain continuing for a week. Only 5 patients (15.6%) reported pain continuing for two weeks. One-third of cholecystectomy patients reported no pain following discharge. 21% reported on a few pain days (2-3 days), and 28.2% reported on pain continuing for a week. Only one patient reported on pain continuing for a month (following cholecystectomy). No patient reported pain continuing more than a month. No patient reported chronic pain following the surgery (Table 2).

Further analysis examined differences in relation to the average time of postoperative pain and found a statistically significant difference ( $p = 0.002$ ) in the duration of pain after the two procedures. Cholecystectomy patients reported 2-3 pain days as opposed to hernia patients who reported a week with pain (Table 3).

Pearson Chi-Square		Total	Open Inguinal Hernia	Laparoscopic Cholecystectomy
.005	No pain/ Don't remember	16	3	13
		22.5%	9.4%	33.3%
	2-3 Days	12	3	15
		30.8%	9.4%	21.1%
	Week	32	21	11
		45.1%	65.6%	28.2%
	Two weeks	7	5	2
		9.9%	15.6%	5.1%
	About a month	1	0	1
		1.4%	0.0%	2.6%

**Table 2:** Distribution of pain days following discharge between two types of surgery/whether acute pain became chronic pain.

p in t test	Open Inguinal Hernia	Laparoscopic Cholecystectomy
0.002	32	39
	2.8	1.8
	1.0	1.4
	Week	2-3 Days
	Two weeks	Month

**Table 3:** Analysis of differences in averages between two types of surgeries in relation to pain days following discharge.

#### Need for pain relievers following discharge

45 (63.4%) patients reported needing to take pain relievers - 28 hernia patients and 17 cholecystectomy patients. 26 (36.6%) patients reported no need for pain relievers / did not remember if they took any - 22 cholecystectomy patients and 4 hernia patients.

There was a statistical significance in the need for further pain relief treatment after surgery between cholecystectomy and hernia patients ( $p < 0.001$ ) (Table 4).

Test		Surgery		
		Total	Open Inguinal Hernia	Laparoscopic Cholecystectomy
Pearson Chi-Square	Need for continued treatment	45	28	17
0.001		63.4%	87.5%	43.6%
	No need/Don't remember	26	4	22
		36.6%	12.5%	56.4%

**Table 4:** Need for pain relievers following discharge between two surgeries.

The majority of patients - 45 (63.4%) - took conventional medication as recommended at discharge. Only one patient used traditional medicine. 35.2% of patients (25) reported not needing any treatment, medication or otherwise. The results show statistical significance of taking medication as opposed to all the rest ( $p = 0.016$ ).

81.3% of hernia patients took medication, 18.8% had no need

for medication or other treatment. 48.7% of cholecystectomy patients took pain relief medication, 48.7% had no need for pain medication. No patients reported using alternative medicine.

#### Visit to family physician for pain

63 (88.7%) patients following surgery did not need consultation / pain treatment with their family physician. The high rate indicates the quality of instruction and taking medications as recommended. Only 8 patients (11.3%) needed the aid of their family physician to manage pain, and there was no statistical difference between procedures. 4 hernia patients and 4 cholecystectomy patients.

#### Visit to Emergency Room for pain

Only one patient following hernia repair suffered pain that required a visit to an emergency room.

#### Assistance from other sources in pain management

91.5% of the patients did not need further consultation. The remaining patients (7%) were assisted by family members and one patient received aid from the internet. No patient turned to customer service of Clalit Health Services or to friends.

#### Gender differences in pain

No statistical differences were found between men and women. Women did not report more pain during discharge. It should be noted that during hospitalization, cholecystectomy patients were given more opioids. (59% of cholecystectomy patients were women). There was also no statistical difference between genders for: duration of pain, needing pain relief, a visit to a family doctor, a return to the ER, assistance with various factors and treatment measures.

#### Continued treatment following discharge

This study did not find incidences of CPSP, and several hypotheses have been raised for the reasons and the attempt to find causes and factors related to the number of pain days after discharge. These tests were performed using the Pearson correlation coefficient. The total amounts of opioids were checked against the number of pain days and there was no correlation between them (0.2). There was no correlation between receiving multimodal treatment and the number of pain days (0.13), nor concerning patient instruction (0.7). The only variable found in correlation with the number of pain days is the continued treatment after discharge ( $p < 0.000$ ) (Table 5).

Univariate analysis - pain days		
Variable	Test	Sig
	P in t-test	
Amount of opioids	Pearson Correlation	0.209
Multimodal treatment	Pearson Chi-Square	0.13
Receiving instruction	Pearson Chi-Square	0.703
Continuation of medication following discharge	Pearson Chi-Square	0.000

**Table 5:** Univariate analysis of pain days.



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## Discussion

The study included 32 patients (45.07%) undergoing open inguinal hernia repair, 39 patients (54.9%) undergoing minimally invasive laparoscopic cholecystectomy. The majority of hernia patients (65.6%) reported pain on the first week after the surgery that was gone by week's end. (Average number of pain days following hernia repair 2.8). For 5 patients (15.6%) pain continued for two weeks and no patient reported pain lasting over two weeks after surgery. Therefore there was no CPSP among the hernia patients.

These findings contradict findings in the literature. CPSP following hernia repair is considered a major problem, studies indicate an incidence of 30% of patients (10) at high intensity, especially after surgery using mesh [4].

Findings for pain after laparoscopic cholecystectomy indicated pain lasting 2-3 days, average of 1.8 pain days. 13 patients (33.3%) reported no pain or did not remember pain, and for 30.8% pain lasted only a few days. Only one patient reported pain lasting a month. CPSP was not found in this study, compared to literature reports of a 3.4% prevalence of CPSP following laparoscopic cholecystectomy.

Differences in results may stem from different definitions of CPSP. In this study existing chronic pain was a contraindication for study participation. Those with diseases involving chronic pain were eliminated from participation with the intent of preventing subjects with central sensitization or pain memory to participate.

In several studies on CPSP after hernia surgery, it turned out later that many patients suffered from headaches, back pain and irritable bowel syndrome [13,23-25]. Another study examined incidence of CPSP confirmed by physical examination found very low rates relative to the literature on hernia, two hysterectomy methods, and thoracotomy procedures [26]. Other researcher notes CPSP incidence in many published studies is higher than in reality due to CPSP definitions [2].

An additional area is the crucial influence of pain management surrounding surgery. Most available findings are from studies that predate established pain treatment policy or guidelines.

We can assume study patients were treated for pain during surgery, but continued pain treatment during hospitalization is unknown. Guidelines for providing round-the-clock care and rescue medication according to pain level have developed slowly since 1995, and a number of articles since 2007 indicate post-operative analgesia is inadequate, possibly due to difficulty in implementing changes, a lack of resources, technical equipment problems, policies and organizational culture [13]. As stated, lack of care or inadequate treatment for high pain levels could cause central sensitization and development of CPSP [10].

Kaplan Medical Center incorporated guidelines and protocols for pain management from 2005, beginning round-the-clock medication and providing rescue medication for the entire patient

population. Medical Center policy, from Health Ministry and Clalit Health Services policies, is to accurately define pain treatment, including directives on postponing discharge of recovery room patients with a pain level over 3. The study findings indicate 60.6% of patients arrived in the surgery ward after surgery with a pain level of zero, the maximum level following a cholecystectomy was 4 and the maximum following hernia repair was 5.

The average opioid amount (calculated to morphine conversions) administered to cholecystectomy patients was 24.74 mg and 22.91 mg to hernia patients. Continuous opioid treatment in recovery room was on average 5.52 mg for cholecystectomy patients with a maximum of 15 mg. The average opioid treatment for hernia patients was 5.4 mg with a maximum of 16.7 mg.

69.2% of cholecystectomy patients were administered an additional medication as per the recommended provision of multimodal analgesia, only 30.8% of hernia patients received another medication, contrary to recommendations for mesh-associated inflammatory pain.

Departmental pain management included round the clock treatment and rescue medication based on degree of pain. The average opioid amount for cholecystectomy patients from ward admission to discharge was 11.64 mg and hernia patients received an average of 10.8 mg. This difference may be due to higher use of opioids among women. (The majority of cholecystectomy patients were women, the majority of hernia patients were men.) A maximum of 50 mg was administered to a female cholecystectomy patient, a maximum of 30 mg was given to a male hernia patient. In addition, 67.6% of patients received multimodal treatment 87.5% of hernia patients and 51.3% of cholecystectomy patients. These differences in treatment are due to care orders from different physicians, often by interns. Another difference may be significant variations in opioid amounts administered in different departments, in accordance with departmental head policies, but this factor does not affect the incidence of CPSP. Central sensitization was averted for study patients by providing sufficient treatment in the operating room, recovery, and departments providing round-the-clock treatment and prevention of breakthrough pain. The results support the assumption of several researchers indicating acute pain is a significant factor in CPSP development, and preventing central sensitization with adequate pain treatment will prevent CPSP. [6,9,12,13,17-20].

Another study hypothesis was that gender differences would be found in CPSP incidence. As mentioned CPSP was not found in study patients, however, several gender differences were found. The study included 45 men (63.4%), (29 underwent hernia repair - 90.6%, and 16 underwent cholecystectomy - 41%) and 26 women (36.6%) (23 underwent cholecystectomy - 59% and 3 underwent hernia repair - 9.4%). The cholecystectomy patients were mostly women and required higher amounts of opioids in the department.

The average opioid amount for cholecystectomy patients was 11.64 mg with maximum 50 mg and the average opioid amount

for hernia patients was 10.28 mg with maximum 30 mg. The higher consumption is not surprising given the gender differences, which involve differences in hormonal, physiological and pharmacological systems. Women have more diseases that involve chronic pain, report higher pain levels, and the pain threshold is different between genders. Men respond better to the  $\mu$  receptor and women to the K receptor. Therefore men respond better to morphine, needing smaller amounts, compared to women requiring higher amounts with more side effects of nausea and vomiting. Other differences result from hormonal changes when testosterone reduces pain and estrogen increases pain. P-450 is found to be more active in women and thus medication is absorbed more rapidly [27]. There were no significant differences in pain upon discharge. Women did not report higher level of pain during discharge.

There were no differences in pain reliever use after discharge, possibly due to different types of surgery. 45 patients (63.4%) needed further pain treatment, of those 31 (68.9%) underwent hernia surgery - most were men - and 14 (53.8%) underwent cholecystectomies - most were women. Other gender differences for pain such as number of days, visits to family physician or emergency for assistance, or alternative help sources, were not found, perhaps due to the small sample.

Patient discharge the day after surgery requires continuing pain medication, including prescriptions and orders issued by a specialist and detailed instructions for further treatment by a nurse. Good instructions enable intelligent use of various health services and contribute to the security of handling various problems that may occur with early discharge. The results indicated most patients described instructions as good or very good, a few as moderate or lower. In all cases, limited use of health services indicates adequate instructions preventing re-hospitalizations, emergency visits, and the low number of physician visits. Only one patient returned to the emergency room with pain.

Most of the predictor variables for development of CPSP were contraindicated for participation in the study. The study examined perioperative analgesia, multimodal treatment, recommendations and training, and continuing treatment with pain relievers.

Of all variables examined in univariate analysis with pain duration after discharge, it was found that only the continuing of consuming pain relieving has a statistical correlation to the number of pain days. This is contrary to the assumption that perioperative care is correlated to duration of pain and progression to CPSP. The finding is also supported by other recent studies [26]. For continuous treatment there were no comparable sources.

Despite these findings it appears that central sensitization was prevented in the operating room, recovery room, and continued with the department providing round-the-clock analgesia and prevention of severe pain outbreaks. The effect of continued care, mainly with anti-inflammatory medications designed to reduce the inflammatory system and heal tissue following surgery, is reflected

in the short number of pain days, as opposed to patients not taking continuous treatment.

In conclusion, this study found no CPSP due to prevention of central sensitization and continued pain treatment after discharge. Study results reinforce other research hypotheses about the importance of perioperative treatment and prevention of central sensitization. The contribution of this study concerns continuation of treatment after discharge. This finding underscores the importance of continued pain medication after discharge and ensuring provision of guidelines, prescriptions and detailed instructions.

#### Implementation of research results

For hernia repair patients, a week of round the clock medication and rescue medication as needed is recommended, along with detailed instructions that emphasize the importance of continuing treatment. For cholecystectomy patients, continuing treatment is recommended for several days.

Study limitations: Small sample, only two types of surgeries, study conducted at one medical center, pain data provided by patients 3 months after surgery.

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