

# Hernias at the laparoscopic cholecystectomy trocar sites

## *Hérnias no sítio do trocarte de videocirurgia para colecistectomia*

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### ABSTRACT

**Introduction:** The surgical approach to the abdomen via laparoscopy has been widely used for cholecystectomy. This access route has demonstrated advantages, including the reduction in the incidence of incisional hernias. Could this really be a reality? **Objective:** This survey aims to show the existence of these hernias and the profile of patients who present them. **Method:** Incisional hernias operated from January 2017 to May 2024, at the Complexo Hospital do Trabalhador were reviewed. The inclusion criteria were: age 18 years or older and having undergone laparoscopic cholecystectomy, excluding those operated on in the emergency room and those whose medical records did not allow the data to be analyzed to be obtained. **Results:** 71 hernias were identified at the trocar site, all in the umbilical position (12.98% of all incisional hernias). It predominated in women (73.24%) and the average age was  $53.99 \pm 13.33$  years. Weight changes were present in 91.05% of patients and obesity in 52.25%. The diagnosis was clinical and the hernias were complex. Furthermore, 38.03% were diabetic and 42.25% had high blood pressure. **Conclusion:** Incisional hernia at the umbilical trocar site in laparoscopic cholecystectomy is highly prevalent, with obesity as the main risk factor.

**Keywords:** Hernia, Ventral. Incisional Hernia. Cholecystectomy, Laparoscopic.

### INTRODUCTION

The abdominal laparoscopic surgical approach has been widely used and for many interventions, such as cholecystectomy, for which it has been the preferred route. It has demonstrated several advantages over open cholecystectomy, such as reduction of postoperative pain, reduction of the incidence of surgical site infections, faster recovery, and reduction of the incidence of incisional hernia when compared with open access<sup>1,2</sup>.

Incisional hernia after laparoscopic surgery is defined as that which forms at the site of the trocar or portal<sup>3-5</sup>.

Although the idea has been propagated that laparoscopic abdominal interventions show fewer incisional hernias, articles have shown that their existence is frequent and most likely underestimated.

Tonouchi et al. established a classification for incisional hernias that form at the portals' site. They admitted three types. The early one indicates dehiscence of the anterior fascial plane, posterior fascial plane, and peritoneum manifests soon after the intervention. The late type indicates dehiscence of the anterior fascial plane and the posterior fascial plane, and in this case the hernial sac is constituted by the peritoneum. They almost always develop slowly and are diagnosed

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several months after surgery. The special type indicates dehiscence of the entire abdominal wall, with protrusion of bowel and other tissues (e.g., greater omentum). In fact, it is an evisceration<sup>6</sup>.

Among the complications reported for the minimally invasive approach is the development of incisional hernia at the sites of epigastric or umbilical portals. The most frequent location of incisional hernia in published studies is the umbilical portal<sup>7-9</sup>.

A meta-analysis including 1,036 patients revealed that the umbilical portal has a higher incidence of incisional hernia than the epigastric one (RR 2.68, 95% CI 1.06-6.80,  $p = 0.04$ )<sup>9</sup>.

Authors have shown incidence rates ranging from 0 to 25%<sup>4,7,10-14</sup>.

The objective of this article is to draw attention to the number of incisional hernias located in the umbilical portal of cholecystectomies and to analyze consequences of, and risk factors for, their development.

## METHODS

This study is part of a large project that was evaluated by the Ethics in Research Committee of the Worker's Hospital/SES/PR and approved by opinion 6.509.155 of November 16, 2023.

We reviewed incisional hernias operated by the General Surgery/Abdominal Wall Service from January 2017 to May 2024 at the Worker's Hospital Complex. We included patients 18 years of age or older who undergone laparoscopic cholecystectomy. We excluded patients operated on in emergency settings and those whose medical records did not allow data analysis.

The analyzed data were sex, age, whether the search was for primary hernia (not submitted to any correction), whether it was recurrence, and the number of recurrences. Among the risk factors, we evaluated history of surgical site infection, obesity, diabetes mellitus, hypertension, smoking, alcoholism, chronic obstructive pulmonary disease, hypothyroidism, anemia, and body mass index/obesity. In clinical history, we recorded the time elapsed between cholecystectomy and hernia diagnosis, clinical diagnosis and type of complementary examination used for confirmation and/or evaluation. In the surgery description, we sought to recognize the size of the hernial ring by measuring the largest diameter, the type of correction used, and the position of mesh placement.

The results were tabulated in an Excel spreadsheet, showing absolute numbers and prevalence in the sample presented. Considering that this was a retrospective and descriptive study, statistical tests were not applied except for percentages, means, standard deviations, maximum, and minimum values.

## RESULTS

In the study period (89 months), 762 incisional hernia repairs were performed. From this amount, we excluded 115 medical records, leaving 547. Cholecystectomy portal hernias totaled 71 patients, representing 12.98% of the incisional hernias operated.

In these 71 patients, there was a predominance of females (52, 73.24%). The mean age was  $53.99 \pm 13.33$  years, with the youngest being 19 years old, and the oldest, 82. Hernias appeared in 42.30% of women under 50 years of age, while in men, in 21.05%. This represents twice as much in women as in men in this age group (Table 1).

**Table 1** - Relationship between sex and age and the presence of hernias.

Age	Male		Female		
	n	% de 19	n	% de 52	
up to 20	0	0.00	1	1.92	
21 to 30	0	0.00	3	5.77	23.08
31 to 40	1	5.26	8	15.39	
41 to 50	3	15.79	10	19.23	
51 to 60	5	26.32	11	21.15	76.92
61 to 70	10	52.63	14	26.93	
71 or more	0	0.00	5	9.61	
TOTAL	19	100.00	52	100.00	

We could not assess the body mass index (BMI) of four patients (5.64% of the sample). Obesity was present in 52.25% of the sample and, when considering overweight, in 91.05% (Table 2).

**Table 2** - BMI ranges in the sample studied.

	n	%		
Underweight (↓18.5)	0	0		
Ideal weight (18.6 to 24.9)	6	8.95		
Overweight (25 to 29.9)	26	38.80		
Obese. Grade I (30 to 34.9)	20	29.85		
Obese. Grade II (35 to 39.9)	10	14.93	52.25	91.05
Obese. Grade III (↑ 40)	5	7.47		
TOTAL	67	100		

Nineteen patients had already undergone hernia repair (26.76%) and three of them were in the second recurrence (Table 3). In the male group, five of the 19 hernias were recurrent (26.32%), and in the female group, 14 of the 52 (26.92%).

**Table 3** - Hernias classification according to number of recurrences.

	n	%	
PRIMARY	52	73.24	
1 RECURRENCE	16	22.53	26.76
2 RECURRENCES	3	4.23	
TOTAL	71	100	

All 71 patients had significant protrusion, and a clinical diagnosis was possible; 14 of them underwent computed tomography, and 18, ultrasound. The exams were requested to assist in the surgical conduct, since they presented bulky hernial sacs with viscera losing domicile.

As for comorbidities, there were 27 diabetic patients (38.03%), three of them insulin-dependent. Systemic arterial hypertension was present in 30 (42.25%). Notably, all of them were losartan users. Twelve patients were hypothyroid (16.90%) and levothyroxine users, and 16 were smokers (22.53%). Regarding alcohol use, 18 individuals did not use it (25.35%), 50 drank socially (70.42%), and three used it unhealthily (4.22%). Only one patient had chronic obstructive pulmonary disease.

Surgical site infection in the previous surgery was reported by 11 patients (15.49% of the sample) and anemia with previous transfusion was found in one

patient who had chronic nephropathy. There was one patient being treated for prostatic neoplasia, one for breast cancer, and one crack and marijuana user.

All patients in this study were elective. The mean time between cholecystectomy and perception of the parietal defect was 1.5 years, with a minimum of three months and a maximum of 2.4 years. According to Tonouchi's classification<sup>6</sup>, all were considered late. They were voluminous hernias, with rings whose largest diameter, which was always the transverse, showed an average of  $5.35 \pm 2.97$ cm, the smallest being three centimeters, and the largest, 20cm.

## DISCUSSION

In recent years, laparoscopic access to the abdominal cavity has gained a large space and for some interventions it has been preferred. For cholecystectomy it is recognized as the gold standard<sup>1</sup>. This approach has demonstrated several benefits over open cholecystectomy, such as reduced postoperative pain, reduced incidence of surgical site infections, faster recovery, shorter hospital stays, and reduced incidence of incisional hernia<sup>1,2</sup>.

Hernia rates may be underestimated by conviction that the laparoscopic approach would lead to a lower incidence of incisional hernia and by patients often overweight or even obesity. Active research could provide better information on the incidence. Üstünyurt et al. suggest searching with ultrasonography<sup>12</sup>. The age range of patients who presented with hernia was higher in men, with age over 40 in 94.74% of time, as opposed to 76.92% in women ( $p=0.001$ ). This may be justified by men seeking surgical treatment for cholecystopathies later or even by their higher frequency in women<sup>22,23</sup>. Botaitis et al. confirmed that men undergo surgery later<sup>24</sup>.

Obesity was an important factor. Only 8.59% of patients were of ideal weight, 52.25% were obese, and 38.80% were overweight. This has been considered one of the most important factors for hernia development. Comanjuncosas et al. conducted a three-year prospective study and reported OR of 2.71 (95% CI 1.28-5.75,  $p=0.009$ )<sup>7</sup>. Other authors reaffirm that obesity is a risk factor<sup>13,25-27</sup>. For Erdas et al., obesity is

the major risk factor ( $p=0.002$ )<sup>28</sup>, as well as for Uslu et al. ( $p < 0.001$ )

Li et al. argue that an increase in visceral fat volume and subcutaneous fat are linked to a higher incidence of incisional hernias after abdominal surgeries. They report association with more challenging fascia closure and higher postoperative recurrence rates<sup>30</sup>. Ciscar et al. considered BMI  $\geq 30$ kg/m<sup>2</sup> capable of increasing hernia incidence by more than three times ( $p=0.043$ )<sup>13</sup>. Nielsen et al. stated that the risk associated with obesity increases significantly in patients with a BMI greater than 40kg/m<sup>2</sup> and considered obesity to be the major risk factor<sup>31</sup>.

In this survey, changes in BMI were present in almost the entire sample (91.05%). This should serve as a warning and prompt intervention, with preoperative reduction in body mass. This intervention must be accompanied by the nutrition service so that lean mass is not compromised.

Authors refer to diabetes mellitus as a risk factor<sup>5,7,26,32,33</sup>. According to Gignoux et al., in a survey conducted in France, diabetes is an important risk factor ( $p < 0.0001$ )<sup>26</sup>. Itatsu et al. confirm this factor, as in survey 18.8% of patients were diabetic ( $p=0.024$ )<sup>34</sup>. In the present survey, 38.03% of patients were diabetic. However, as this study is retrospective and uncontrolled, it is not possible to infer a correct relationship between diabetes and hernia development in this group.

Systemic arterial hypertension (SAH) is also a risk factor. Itatsu et al. found hypertension in 36.9% of patients ( $p=0.042$ )<sup>34</sup>. In this survey, 42.25% were hypertensive. However, most of them were over 50 years of age, when SAH is more prevalent. SAH is a disease of small resistance arteries. There is significant impairment of arteriolar vascular tone, with morphological alterations in microcirculation characterized by alteration of the lumen/wall thickness ratio<sup>35</sup>. Wound healing depends on many factors. Among them is adequate vascularization, since the speed of healing process depends on oxygen. Collagen synthesis requires an adequate concentration of oxygen for hydroxylation of proline and lysine and, in the final phase, for the removal of the terminal peptide, leading to molecular organization. Adequate tissue perfusion

is good oxygenation and wound nourishment. Thus, tissue ischemia caused by arterial hypertension would be detrimental to wound healing<sup>36</sup>. Another point to be considered is the use of some medications. Among these drugs is losartan, an antagonist of AT1 receptors of angiotensin II. At the experimental level, wounds from hypertensive animals treated with losartan are less resistant and have lower collagen density<sup>36</sup>. Sampaio et al. demonstrated that topical angiotensin II converting enzyme receptor inhibitor losartan, a known inhibitor of TGF- $\beta$  signaling, decreased fibrosis of late healing and myofibroblast generation after PRK of -9.00 D in rabbits, and decreased non-basal type IV stromal collagen produced by TGF- $\beta$ -modulated corneal fibroblasts, probably also through inhibition of TGF- $\beta$  signaling<sup>37</sup>. However, more studies are needed for more accurate information.

A widely discussed factor is smoking. In a follow-up of 253 patients who underwent laparoscopic cholecystectomy by a single surgeon, Zardzinski et al. reported the significant occurrence of hernia at the site of the umbilical portal ( $p < 0.05$ ) and drew attention to the condition that active smokers have a higher risk of developing umbilical hernia after minimally invasive cholecystectomy<sup>38</sup>. Sørensen et al. stated that smokers are four times more likely to develop an incisional hernia<sup>39</sup>. Sabajo et al. identified smoking as a risk factor in hemicolectomy, with OR = 2.14 ( $p=0.040$ )<sup>40</sup>. Smoking decreases tissue oxygenation and aerobic metabolism. The inflammatory response is attenuated by a reduced chemotactic response of inflammatory cells, migratory function, and oxidative bactericidal mechanisms. In addition, the release of proteolytic enzymes and inhibitors is unbalanced. The proliferative response is impaired due to reduced fibroblast migration and proliferation, as well as downregulated collagen synthesis and deposition<sup>41</sup>. In this study, 22.53% of patients were smokers, drawing attention to this situation.

A situation that still needs to be widely studied is the coexistence of hypothyroidism. The prevalence of overt hypothyroidism in the general population is 4.6% in the US and 3.8% in Europe. According to authors, hypothyroidism occurs more frequently in women, older (over 65 years of age) and in white individuals<sup>42</sup>. In

Brazil, the rate of subclinical hypothyroidism was found to be 6.5% among older adults and 12.3% in women over 35 years of age<sup>43</sup>. The symptoms of weight gain and fluid retention among hypothyroid patients are known. When it comes to influences on healing, there is little information. An experimental study showed lower collagen concentration in all tissue planes of the abdominal wall of rats during tissue reconstitution<sup>44</sup>. It has not been routine in preoperative evaluations to investigate thyroid conditions.

Alcohol intake is a very common condition in populations. It almost always infers harm when patients present with liver cirrhosis and/or ascites. In this study, 74.22% of patients ingested alcohol, though only 4.22% in amounts considered unhealthy. Liver function tests were normal.

Although chronic obstructive pulmonary disease (COPD) is widely cited as a risk factor and Gignoux et al. attributed significance to  $p < 0.0001$ <sup>26</sup>, in this study only one patient had COPD.

Among the local factors, surgical site infection (SSI) is mentioned by almost all authors, especially in the umbilical area. Comajuncosas et al. inferred high significance ( $p < 0.001$ )<sup>7</sup>. In this study, 15.49% of patients reported SSI. It was not possible to collect information on the existence of hematomas and/or seromas.

Another factor, currently much questioned, is the fascial closure at the portals' sites and the trocars' size. In a survey with 18,533 patients, Gutiérrez et al. observed that the rate of incisional trocar site hernia (TSH) was lower when using bladeless trocars for any trocar size. When comparing whether fascial closure

had an effect, the 5mm and 10mm trocars had no difference in incidence rates. In addition, trocars at midline sites resulted in higher TSH incidence rates<sup>45</sup>. Helgstrand et al. observed that trocars of 10 mm or more offered the highest incidence (96%) and were more frequent in the umbilical port (82%)<sup>46</sup>. Many authors are publishing the appearance of TSH with trocars of 10 mm or more and recommend fascial closure of these incisions. Even with trocars smaller than 5 mm, hernias have been reported<sup>49,50</sup>.

There is no evidence to recommend routine closure of 5 mm trocar incisions. The choice should continue to be left to surgeon discretion<sup>50</sup>. Finally, it is necessary to remember that the portals can be enlarged when parts are removed or even by the distension promoted by the gases.

This survey showed high prevalence of hernias in such incisions. It should be noted that the number presented here may be underestimated, since these patients arrived at the hernia outpatient clinic when they already had abdominal wall deformity. It is possible that the trocar site hernia is being underdiagnosed, whether due to a lack of related symptomatology, or due to short postoperative follow-up time. The onset is not always early, so follow-up should be for two or even three years, and search should be active. In addition, care with wall closure must be rigorous.

## CONCLUSION

Incisional hernia at the site of the umbilical trocar of laparoscopic cholecystectomy is highly prevalent, with obesity as a major risk factor.

## R E S U M O

**Objetivo:** A abordagem cirúrgica do abdômen por videolaparoscopia tem sido amplamente utilizada para a colecistectomia. Esta via de acesso demonstrou vantagens e entre elas cita-se a redução da incidência de hérnia incisional. Seria isto mesmo uma realidade?

**Objetivo:** Este levantamento visa mostrar a existência destas hérnias e o perfil dos doentes que as apresentam. **Método:** Foram revisadas as hérnias incisionais operadas no período de janeiro de 2017 a maio de 2024, no Complexo Hospital do Trabalhador. Como critério de inclusão estabeleceu-se: idade igual ou superior a 18 anos e ter sido submetido à colecistectomia por videolaparoscopia, tendo-se excluídos os operados na emergência e aqueles cujo prontuário não permitiu a obtenção dos dados a serem analisados.

**Resultados:** Foram identificadas 71 hérnias em sítio de trocar, todos na posição umbilical (12,98% do total das hérnias incisionais). Predominou em mulheres (73,24%) e a média de idade foi  $53,99 \pm 13,33$  anos. Alterações de peso esteve presente em 91,05% dos pacientes e obesidade em 52,25%. O diagnóstico foi clínico e as hérnias eram complexas. Ainda, 38,03% eram diabéticos e 42,25% hipertensos. **Conclusão:** A hérnia incisional no sítio do trocar umbilical da colecistectomia videolaparoscópica é altamente prevalente tendo como principal fator de risco a obesidade.

**Palavras-chave:** Hérnia Ventral. Hérnia Incisional. Colecistectomia Laparoscópica.

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