# **Review Article**

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# Types and causes of chronic pain after laparoscopic operations

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### **ABSTRACT**

Laparoscopy has been introduced as a minimally invasive approach that has been developed to achieve the intended outcomes by open surgeries but with less frequent body injuries and complications. However, evidence indicates that the reported favourable outcomes are mainly based on retrospective data and using historical controls and only a few prospective investigations and clinical trials were published. Furthermore, studies have also demonstrated that following laparoscopy, severe pain can develop similar to or equal to the pain reported during open surgeries that develop within the earliest hours due to the significant tissue trauma introduced by laparoscopy. The present literature review discussed the different causes and types of chronic pain following laparoscopy. We also shed more light on the potential mechanisms and pathophysiology that attributes to the development of pain following laparoscopy. Many studies have indicated the development of chronic pain after 3, 6 and 12 months after hysterectomy, cholecystectomy, nephrectomy, colorectal surgeries and other abdominal surgeries. The development of postoperative main might be attributed to the tissue or nerve injury and associated inflammatory status that can also aid to the development of pain in such settings. Evidence also shows that the incidental pain following laparoscopy is similar or superior to that following open surgeries. Therefore, further interventional approaches are needed to enhance the outcomes.

**Keywords:** Laparoscopy, Surgery, Abdominal surgery, Hysterectomy, Cholecystectomy, Nephrectomy, Abdominal surgery, Pain, Chronic pain, Complication

# INTRODUCTION

Laparoscopy has been introduced as a minimally invasive approach that has been developed to achieve the intended outcomes by open surgeries but with less frequent body injuries and complications. Evidence indicates that the modality generally offers safer practices than open surgery and achieves the same intended outcomes at similar efficacies, which have been reported with a less severe perioperative condition and a faster healing process with reduced pain intensity and scarring.

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Various comparative investigations indicated laparoscopy offers less consumption of analgesics and painful events as compared to open surgery. This can significantly contribute to early hospital discharge following laparoscopy. 1-3 However, evidence indicated that the reported favorable outcomes were mainly based on retrospective data and using historical controls, and only a few prospective investigations and clinical trials were published. Furthermore, studies have also demonstrated that following laparoscopy, severe pain can develop similar to or equal to the pain reported during open surgeries that develop within the earliest hours due to the significant tissue trauma introduced by laparoscopy.3-5 Chronic pain was also reported as a potential complication in many cases within different settings. In the present literature review, we aimed to discuss the types and causes of chronic pain following laparoscopy based on evidence from studies in the literature.

#### **METHODS**

This literature review was based on an extensive literature search in Medline, Cochrane and EMBASE databases which was performed on 26 September 2021 using the medical subject headings (MeSH) or a combination of all possible related terms, according to the database. To avoid missing poetential studies, a further manual search for papers was done through Google Scholar, while reference lists of the initially included papers. All relevant papers were screened for useful information, with no limitations posed on date, language, age of participants or publication type.

## **DISCUSSION**

It had been expected that laparoscopic approaches would decrease the incidence of postoperative pain. However, evidence showed that although the incidence of pain had slightly decreased following these procedures, it was still a major concern and was high among the different surgical settings. A previous multicenter investigation that was conducted in Europe demonstrated that the prevalence of moderate and severe chronic post-operative pain was 11.8% and 2.2%, respectively at 12 months following the operation. Chronic pain in this investigation was assessed using a numerical scoring system (0-10) and the pain was defined as having a score of more than 6.6 Evidence showed that the development of chronic pain was a common event following laparoscopy. It had been reported that shoulder pain, which had been reported to develop as a dull pain, in addition to upper abdominal pain which was also reported by many patients in this setting. It had been furtherly demonstrated that the incisional pain might be more frequent and intense than the aforementioned shoulder and visceral pain and might persist for up to several weeks. 7-9 However, evidence indicated that the risk of developing chronic pain significantly increased when the affected patient suffered from visceral pain more than shoulder and incisional pain. 10

Chronic pain had been reported in different surgical settings. During a hysterectomy, previous two investigations that were conducted in the previous two years demonstrated that after performing hysterectomy for benign causes for their included population, the estimated incidence for developing chronic post-operative pain was 26% after performing either of vaginal or laparoscopic hysterectomy by six months following the procedure. 11,12 It had been furtherly demonstrated that the incidence of moderate-to-severe postoperative pain in these settings at 3 and 12 months was found to be 10.2% and 9%, respectively, following laparoscopic, abdominal or vaginal hysterectomy. In the previous investigation that was conducted by Pokkinen et al in 2015 the authors also reported that laparoscopic approach, suffering from severe pain following the surgery by four hours and having a personal history of smoking were all estimated to be significant risk factors for developing chronic postoperative pain following vaginal or laparoscopic hysterectomy. 11 On the other hand, the previous investigation conducted by Theunissen et al in 2016 reported that the estimated risk factors for developing postoperative pain were chronic surgery-related infections, developing postoperative pain within four days and surgery-related worries following laparoscopic, abdominal or vaginal hysterectomy.<sup>12</sup>

The incidence of chronic postoperative pain in the settings of abdominal surgery was also high. For instance, in an investigation by Holtzman et al in 2014, the authors indicated that the incidence of chronic pain at 6 and 12 months among patients that underwent liver donation procedures was 31%, and 27%, respectively.<sup>13</sup> The authors also demonstrated that anxiety related to postoperative pain, young age and being female were the most significant risk factors associated with developing chronic postoperative pain. Another previous study also assessed the frequency of developing chronic postoperative pain following abdominal-based autologous breast reconstruction and found that the incidence rates at 6 and 12 months were estimated to be 24% and 23%, respectively. Moreover, the authors also demonstrated that a higher risk for developing chronic postoperative pain among their included population was estimated for patients that reported a significant variability of the minimum and maximum threshold of pain within the 1st two days after the surgery. 14 Different investigations have also described the development of chronic postoperative pain following abdominal laparoscopy. For instance, a retrospective investigation that was conducted by Joris et al reported that the estimated incidence of chronic postoperative pain for patients that underwent laparoscopic colorectal surgeries was 17%. 15 It had been furtherly demonstrated that this incidence was similar to the incidence estimated for conducting open surgeries. Furthermore, the reported significant risk factors for developing laparoscopy-related chronic postoperative

pain were preoperative pain, inflammatory bowel diseases and performing a redo surgical approach for managing anastomotic leakage. Another retrospective questionnairebased investigation was also found in a similar setting by Jeppesen et al that reported that conducting emergency laparotomy for bowel obstruction was associated with an estimated incidence of 21% for chronic postoperative pain.16 It should be noted that evidence among the different studies in the literature indicated that chronic postoperative pain was common following laparoscopic approaches.<sup>15</sup> At the same time, endoscopic surgeries were estimated to lower the prevalence of the condition within the different surgical settings like surgery for inguinal hernia.<sup>17</sup> On the other hand, a previous investigation by Alper et al demonstrated that no significant differences were noticed in terms of chronic postoperative pain for patients undergoing open and laparoscopic nephrectomy. 18 Postoperative chronic pain reported following was also laparoscopic cholecystectomy. It had been demonstrated that many components and factors can contribute to the development of chronic pain following this procedure. These components included visceral pain (deep abdominal pain), somatic pain (incisional pain) and referred pain (shoulder pain). 19 Various pain trajectories have been reported for these different components of pain and evidence indicated that incisional pain contributes to the highest score of pain. It had been demonstrated in a previous investigation that the response to the visceral pain that is reported within the first week following the operation significantly determines the development of chronic pain.<sup>10</sup>

Many factors can attribute to the development and persistence of postoperative chronic pain after laparoscopy. Insufflating the abdominal cavity with carbon monoxide and gas remaining within the cavity after pneumoperitoneum were the main factors that attributed to the development of post-surgical abdominal pain. Furthermore, evidence showed that many causes were involved in the development of pneumoperitoneum postoperative pain. These included the effect causes by the insufflated gases and neuropraxia of the phrenic nerves that was usually induced by the distension of the abdominal cavity by these gases. Other factors also included the temperature and type of the used gases, the residual gas volume, the presence of an acidic intraperitoneal status as a result of the increased percentage of carbon monoxide gases within the peritoneum, the presence of drains, wound size and other individual and sociocultural parameters. 20-24 Evidence also indicated that humidified and warmed gases were less likely to cause complications and postoperative pain being less irritative. 20,21 As previously mentioned that increase of carbon monoxide within the abdominal cavity can significantly increase acidity. Furthermore, evidence showed that the subsequent acidic intraperitoneal milieu was strongly associated with pain. However, it had been furtherly demonstrated that the condition had significant immunoprotective effects and it had been reported that

the condition attributed to the significant increase in the inflammatory following laparoscopic operations more significantly than open surgical approaches. 25,26 This can lead to chronic pain in severe persistent cases. The main causes of pain following laparoscopic approaches have been attributed to the presence of tissue trauma at the different incisional sites. Penetration of the ligaments and muscles occured at the port sites, leading to the development of nociceptive pain, in addition to the potential presence of neuropathic pain as a result of nerve injury at these sites.<sup>27</sup> Significant systematic changes to the bodies of the affected patients were also observed following surgery and pneumoperitoneum and evidence indicated that inflammatory pain following these practices can also contribute to the development of chronic postoperative pain following laparoscopy similar to the aforementioned mechanisms.<sup>28</sup> Ligation site-related necrosis and ischemia were also other potential factors that can lead to the development of chronic pain. It had been demonstrated that it would be difficult to control this type of pain with the administration of routine analgesics and therefore, achieving better interventions offered better prognostic and management outcomes. In this context, evidence indicated that the outcomes of gynecological surgeries were affected by the approached methods of tubal ligation. Loop and clip occlusion techniques have been reported to be associated with the highest intensity of postoperative pain, electrocoagulation techniques were associated with the lowest intensity of pain.<sup>29</sup> Accordingly, the current evidence indicated that postsurgical pain following laparoscopy usually developed as nociceptive pain (visceral pain from the abdominal organs and superficial and deep somatic pain), inflammatory pain (tissue trauma) and neuropathic pain (nerve injury or manipulation). The time course and intensity of these different types of pain were inconsistent based on the status of the affected patient. Accordingly, the management approaches for these types of pain following laparoscopy should be done based on the different parameters of pain to achieve better outcomes.

Estimates showed that following laparoscopic operations, the pain had been reported to be the most commonly reported manifestation and had been associated with increased rates of convalescence and prolonged hospitalization following laparoscopy.<sup>19</sup> Evidence furtherly demonstrated that this pain was similar to or even more severe than the postsurgical pain that followed open surgeries. 4,30 Analgesic consumption and intensity of post-incisional pain were significantly associated with the magnitude of deep tissue injury.<sup>31</sup> On the other hand, it had been demonstrated that opioid use of pain rating was not significantly associated with the incision site per se. In addition to the trauma-induced to the abdominal wall during mini-invasive surgical approaches like laparoscopy, other means that were usually used perioperatively also contributed to the development of pain, including the use of monopolar electrosurgical energy. On the other hand, enhanced outcomes were

reported to be significantly associated with using ultrasonic dissection modalities.<sup>9,32</sup> The presence of drains was also associated with the development of shoulder pain.<sup>24</sup> Furthermore, recent evidence indicated that shoulder and abdominal pain were usually associated with drainage following laparoscopy during the phase of early recovery.<sup>28,33,34</sup> It had been demonstrated that postoperative pain had the highest intensity following laparoscopy within the first hours and the intensity progressively declined within the first week.4,35-37 However, evidence also indicated that such intensity was significantly variable among patients based on each operation's status and risk factors. 19,35 As a result of the increasing incidence of pain following laparoscopy, further approaches should be offered to reducing the intensity of this pain and applying adequate interventions against the different risk factors that were reported to attribute to the development of pain in the different surgical settings. In this context, further management protocols and awareness campaigns were needed to increase knowledge and safety practices among surgeons and clinicians and enhance patients' outcomes and quality of life.

### **CONCLUSION**

Many studies have indicated the development of chronic pain after 3, 6 and 12 months after hysterectomy, cholecystectomy, nephrectomy, colorectal surgeries and other abdominal surgeries. The development of postoperative main might be attributed to the tissue or nerve injury and associated inflammatory status that can also aid to the development of pain in such settings. Evidence also shows that the incidental pain following laparoscopy is similar or superior to that following open surgeries. Therefore, further interventional approaches are needed to enhance the outcomes.

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