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Analgesia for Postoperative Pain in Laparoscopic Surgery: Review Article

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ABSTRACT

Background: Similar to all surgical procedures, patients have compelling postoperative pain. The patients experience severe abdominal and throat pain at the start of the postoperative period and seek for pain relief after laparoscopic surgery. Laparoscopy is a procedure that is done on a rather frequent basis. Delivering anesthesia in this type of procedures may be difficult, especially in day case surgeries. Inadequate analgesia along with nausea and vomiting may be distressing for patients and raises the health care costs due to extended stay.

Objective: This review article aimed to address strategies for anesthesia and analgesia for day-case laparoscopic procedures in this review. The concepts include multi-mode analgesia as well as oral administration wherever feasible.

Methods: These databases were searched for articles published in English in 3 data bases: PubMed, Google scholar and science direct. Boolean operators (AND, OR, NOT) had been used such as laparoscopy and postoperative pain OR minimally invasive surgery and in peer-reviewed articles between December 2000 and Jun 2021. Documents in a language apart from English have been excluded as sources for interpretation. Papers apart from main scientific studies had been excluded (documents unavailable as total written text, conversation, conference abstract papers and dissertations).

Conclusion: It is important to identify patients at the highest risk for severe and prolonged post-operative pain, and to have a proactive strategy in place for these individuals to reduce the intensity and of postoperative pain in patients undergoing laparoscopic surgery.

Keywords: Laparoscopy, Postoperative pain, Analgesia.

INTRODUCTION

The advancement of minimally invasive surgical procedures for diagnostic and therapeutic purposes has led to a drastic and substantial shift in the way surgery is used to handle many types of disorders [1]. Minimally invasive surgery (MIS), particularly laparoscopic surgery, has gained widespread acceptance as a viable alternative to traditional exploratory laparotomy in the treatment of a variety of benign disorders [2]. Among them, MIS has been considered to be the best option for some types of disorders, like endometriosis [3]. MIS has been shown to be equally successful as traditional laparotomy in the treatment of some forms of cancer. This is because it offers the same benefits as standard laparotomy without compromising the oncologic results. Even if several new papers express grave concerns regarding the safety of MIS in the treatment of cervical cancer [4]. MIS has an edge over conventional exploratory laparotomy, including a substantial minimizing in the size of the incision wound, decreased pain caused by the wound, decreased need for analgesia, trifling trauma and injury, improved cosmetic outcome, fewer days of hospitalization, shorter time for recuperation, and faster resuming of life activities and work [5].

Despite the benefits of MIS, up to 80% of patients (range: 35%–80%) endure significant pain and demand pain medication for their uncomfortable experience or distress [6]. Pain characteristics vary between laparoscopic surgery, particularly gas laparoscopy, and exploratory laparotomy. The most prevalent examples are shoulder-tip pain (STP) and upper abdomen discomfort [7]. Early release and a shorter hospital stay are common with patients having MIS; nevertheless, by contributing to the high likelihood of doctors and patients being inexperienced with post-MIS pain, this leads in missed diagnoses, insufficient assessment, and incorrect therapy. Certain types of post-MIS pain are excruciating, resulting in a considerable increase in needless analgesic usage, a delayed recovery, longer hospitalization, and, in rare cases, readmission [7].

A deeper comprehension of the cause and/or pathophysiology of postoperative MIS pain may be assumed and established as a result of the increasing number of clinical studies and a more refined strategic algorithm for regulating and orchestrating prevention and care [8].

Pain:

As previously stated, MIS often results in less pain compared to exploratory laparotomy. Despite that, post laparoscopic pain continues to impair quality of life and is a significant cause for postponed dismiss or difficulty in returning to routine activities. Post-MIS discomfort may be classified as surgical incision pain, STP and/or upper abdominal pain [9].

Pain is a sensation and a psychological experience linked to existing or probable tissue injury. Acute pain is the physiological response expected in response to a harmful chemical, thermal, or mechanical stimulus, as a result of activation of pain receptors (nociceptors) at the injury site, which performs a crucial and sensitive role in delivering

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warning signals to avert further harm and potentially rescue from the injury [10]. Acute pain is also associated with sympathetic nervous system activation, as shown by tachycardia, diaphoresis, shallow and fast breathing patterns, anxiety, irritability, restlessness, pupil dilation, grimacing, pallor, and/or hypertension. Because MIS-related pain includes the skin, peritoneum, and viscera, the pain might be nociceptive or non-nociceptive. This includes somatic pain (which is typographically well-defined) and visceral pain (which is diffuse and imprecisely defined typographically, referable, and related to motor and autonomic reflexes like nausea and vomiting), while the latter also involves idiopathic or neuropathic pain [10].

Nociceptive pain initiates with the release and production of various factors, including globulin, arachidonic acid, protein kinases, substance P, histamine, nerve growth factor and calcitonin gene-related peptide, and then stimulates or sensitizes peripheral nociceptors. Following that, converting painful stimuli to electrochemical impulses and transferring them to the spinal cord's dorsal horn and crossing (thalamus or other brain areas like dorsolateral pons). Acute and localized rapid pain is mediated by myelinated afferents with medium sized diameter, including A-delta, also referred to as type I, which has a higher thermal threshold but a lower threshold for chemical and mechanical stimuli. Type II, which has a much higher temperature threshold but a much higher mechanical threshold. In contrast, an inadequately confined and gradual pain is transmitted by unmyelinated fibers with a small diameter (polymodal fibers that responds to both mechanical and thermal noxious stimuli) [10].

Incisional wound pain:

To perform incisional wound, a cut in the epidermis, subcutaneous tissues, and peritoneal tissues is needed. They may range from a single incision to many and independent incisions [1]. It produces tissue damage (wounds), which stimulates peripheral nociceptors, resulting in the perception of pain [10]. Additionally, inflammation of the incision might activate the nociceptors, aggravating the pain [19]. Aspirin and other nonsteroidal anti-inflammatory medications, both selective and nonselective, have been shown to decrease prostaglandin E2 synthesis and act as powerful analgesics [11]. Additionally, some opioid analgesics or central pain-relieving medicines, like paracetamol, or steroid medications are routinely utilized postoperatively [12]. The medication stated above may be administered orally, intravenously, or intramuscularly; nevertheless, only the oral version can be taken upon dismiss. While oral medicine is handy, it may cause irritation of the gastrointestinal system and other adverse effects such as allergies. Therefore, fast and appropriate pain management is desired to limit pain scores (visual analog scale [VAS] ranging from 0 to 10 cm) and to avoid the need for further treatment after dismiss. As a result, wound infiltration with local anesthetic drugs performed at the conclusion of surgery is evaluated [13].

Treatment:

Numerous grounds support the use of procedure-specific analgesics after laparoscopy. Until a decade ago, appropriate analgesic therapy after laparoscopic cholecystectomy was a difficulty [14]. In the following are some of the currently utilized drugs and techniques in management of post-laparoscopy pain.

- **Analgesic drugs**

Numerous studies comparing particular medications to placebo exist, however very few treatments were directly compared to each other. A comprehensive review enabled the creation of comparative analgesic strength tables [15]. The findings are expressed in terms of the Number of Patients Needed to Treat (NNT). Paracetamol 1 g has an NNT of 4.6 for 50% reduction in moderate-to-severe pain, although this is decreased to 1.9 when combined with codeine 60 mg. The NNT of morphine 10 mg intramuscularly is 2.9. Diclofenac 100 mg is the most efficient non-selective non-steroidal anti-inflammatory medication (NSAID), with an NNT of 1.8 [15].

Although specific COX-2 inhibitors are apparently more effective, concerns have been raised about their increased cost and thrombotic risk The majority of anesthetists use multimodal analgesia, or the use of many medications to maximize analgesia while minimizing the adverse effects associated with high dosages of individual medicines. At the moment, we use a number of medicines and anesthetic procedures that have been shown to be successful on their own [Table 1] [15]. However, the overall 'recipe' is seldom evaluated explicitly.

Table (1): Guidelines for day surgery analgesia applied at St. Michael's Hospital, Bristol, UK [15].

	Comments
Oral premedication (2 hours preoperative)	
Paracetamol 1 g	If there are difficulties swallowing pills, use soluble paracetamol.
Meloxicam 15 mg (7.5 mg for age > 70) + little quantity of water to assist with swallowing	enteric coated diclofenac 100 mg (or 50 mg)
Intraoperative (If no premedication has been provided, induction should include intravenous paracetamol 1 g and parenteral NSAID)	
Fentanyl 200 μg	Alter dosage to population; decrease/cancel if there is a significant risk of PONV.
Morphine 10 mg	Adjust dosage based on demographics; omit if there is a low risk of PONV.
Sterilization operation-local anesthetic into mesosalpinx 0.25% bupivacaine 2 mg/kg divided between peritoneum and wounds gas drainage	Ascertain that the utmost quantity of gas is released prior to port removal.
Postoperative	
For severe pain	
PACU - intravenous fentanyl 20 μg increments up to 3 minutes	
Step-downward-intramuscular morphine 7.5-10 mg	
For moderate/mild pain	
Paracetamol 1 g - check time elapsed since first dose	
Codeine 30-60 mg	Oral morphine solution - dosage and frequency should be determined in accordance with local medication dispensing rules.
NSAID - determine the time period from the first dosage of tramadol - if a NSAID is contraindicated	

PACU - Post-anesthesia care unit = Recovery ward, PONV - Post-operative nausea and vomiting, NSAID - Non-steroidal anti-inflammatory drug.

- **Preemptive analgesia**

According to theoretical considerations, administering analgesics prior to the surgical intervention should lower postoperative pain compared to administering analgesia after the surgical stimulus. This has a negligible influence in practical practice. However, administering analgesics before to or early in the course of the surgery ensures that by the time the patient awakens from general anesthesia, the medicine has been absorbed and distributed to the affected area. Prior to awakening, optimal analgesia reduces the requirement for powerful opioids in the Post-Anesthesia Care Unit (PACU; recovery ward). This is done in order to minimize adverse effects and increase patient satisfaction [16].

- **Routes of administration**

Oral administration is suitable for day-case surgeries since it normally has little effect on gastrointestinal function (only if there is no PONV). Tablets may be administered both pre- and post-operatively, assuming the patient is able to tolerate drinking. Due to the difficulties in timing the final intake and the commencement of anesthesia, starvation restrictions are often implemented more strictly than required. While this is sensible for food consumption, It is less reasonable in terms of fluid consumption due to the repercussions of pulmonary inhalation of undigested food. Within two hours, water, isotonic beverages, and pure fruity juices are eliminated from the stomach. When suppositories are administered under general anesthesia, it is prudent to provide them prior to surgery as opposed to after the ending to provide a chance for medication absorption and dispersion. For patient comfort, drugs that must be administered intramuscularly, such as prochlorperazine, should preferable be administered under general anesthesia [17].

- **Paracetamol (Acetaminophen)**

Paracetamol is the lowest-ranking medication on the World Health Organization's (WHO) pain scale. It is effective for treating mild to moderate pain and may reduce the need for morphine by up to 20% when administered for more severe pain. However, it has no influence on the occurrence of morphine adverse effects. It is unknown if the addition of paracetamol to NSAID offers any advantage over the NSAID alone. However, paracetamol is inexpensive and has a limited number of adverse effects. Thus, it would be prudent to utilize it [18].

- **Non-steroidal anti-inflammatory drugs**

NSAIDs, either alone or in combination with paracetamol, are unlikely to offer enough analgesia in the early postoperative period, but may help minimize the need for opioids. While the majority of research demonstrate an advantage, this is not uniform. They are, nevertheless, often utilized in day-case anesthesia.

As previously stated, diclofenac 100 mg is the most effective non-selective NSAID (NNT 1.8) [19].

- **Opioids**

Opioids are at the pinnacle of the WHO's pain scale and are often utilized as a component of day-case general anesthetics, however a method that is entirely free from opioids may be explored for subjects having minor surgeries at a highly increased risk of PONV. Usage of oopioids may be preoperatively, intraoperatively, or postoperatively and can be used in short- or long-acting forms [15].

- **Analgesic adjuncts**

While pain is often managed with injectable opioids and NSAIDs in conjunction with localized infiltration of the sites of incisions, additional innovative approaches have been documented [20]. Alternative drugs such as pregabalin and ketamine have also been studied due to the difficulty of delivering good pain management [21, 22]. Regardless of their effectiveness, all parenteral drugs may cause adverse reactions. As a result, interest in using topical peritoneal medicines grown, such as local anesthetic drugs. During the laparoscopic surgery, the local anesthesia drug is aerosolized into the peritoneal cavity in these trials [23, 24]. Topically targeting the peritoneum makes sense, since gas insufflation with elevated intra-abdominal pressure leads in peritoneal inflammation and neuronal rupture, with a linear connection between abdominal compliance during the surgery and the degree of postoperative pain [20]. However, some studies assert that there is no difference in the degree of analgesia when the local anesthetic drug is administered systemically (intravenously) vs peritoneally [25].

- **Local anesthesia**

Local anesthetics such as mesosalpinx block and various kinds of direct injection of local anesthetic to the region are used to alleviate discomfort after laparoscopy [26]. Although surgical knowledge was necessary for the mesosalpinx block, the dosage of local anesthetic needed was around 2 cc per side due to the exact placement [27].

Covering Filshie clips with a local anesthetic, such as aqueous lignocaine, as well as a gel [28], has also been attempted [29]. In both trials, when lignocaine was administered to the clips, pain ratings decreased. This was substantial, however, just one hour postoperatively. None of the trials have ever employed bupivacaine with a longer half-life. Any procedure that decreases the patient's pain threshold upon awakening from general anesthesia improves the patient's experience and decreases the chance of PONV.

Regional anesthesia

Regional anesthetic procedures such as rectus sheath block, transversus abdominis plane block, erector spinae block, quadratus lumborum block, inguinal block, and caudal block are beneficial adjuncts to general anesthetics and ease post-laparoscopic analgesia. Other approaches, including spinal and epidural anesthesia, as well as a mix of both, are acceptable for laparoscopy as the only anesthetic technique. [30].

- **Gas drain**

The efficacy of a gas drain in reducing discomfort after laparoscopy was investigated. This is a suction catheter with holes at the end and on the sides that was inserted via the trocar at the end of the operation. The trocar is dislodged from the catheter and a safety pin is placed through it. After six hours, the drain gets detached. The median VAS for Gas-related pain was significantly reduced till the afternoon of the first day following the surgery, and the frequency of discomfort was reduced till the afternoon of the second day following the surgery. Simpler techniques for eliminating CO_2 at the conclusion of laparoscopy have been used [31].

- **Gas warming**

A new meta-analysis found that humidifying and warming the insufflated carbon dioxide considerably lowers discomfort during laparoscopy, even up to three days after the procedure [31].

- **Antiemetics**

Around 20-30% of surgical patients may develop (PONV), and around 1% of day surgery patients will need overnight admission as a result [15]. The cost-effectiveness of prophylactic antiemetics in general, and particularly for more costly medications, has been disputed. PONV was found to be preventable by a multimodal approach that included complete intravenous anesthetic and three antiemetic medicines [32].

CONCLUSION

It is important to identify patients at the highest risk for severe and prolonged post-operative pain, and to have a proactive strategy in place for these individuals to reduce the intensity of postoperative pain in patients undergoing laparoscopic surgery.

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