Chapter 6

Hernia in Ambulatory Surgery Centre

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Additional information is available at the end of the chapter

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Abstract

Surgical treatment of hernia is one of the most common procedures in general population. Since it was traditionally treated as "non-complex" operation, it is an ideal procedure for ambulatory surgery settings. Ambulatory surgery is superior to in-hospital treatment due to faster patient flow, reduced patient stress, early mobilization, and lower overall costs. Unforeseen hospitalization can be avoided with meticulous patient selection, education and preparation, use of local anesthesia whenever possible, and avoidance of opioids in early postoperative period.

Keywords: inguinal hernia, ambulatory surgery, day surgery, hernia repair, antibiotic prophylaxis, thromboprophylaxis, mesh, hernia sac, laparoscopy, local anesthesia, PONV

1. Introduction

Hernia surgery is one of the most frequently performed surgeries and one of the most frequently performed operations in the ambulatory surgery settings. However, setting up and performing hernia procedures in ambulatory surgery often present a challenge both to the surgeon and to the patient. Only by challenging the unproven dogma, which still exists regarding the routine management of outpatients undergoing ambulatory surgery procedures, one will advance current practices in the future. Maximizing the use of minimally invasive technology and new prosthetic devices, more complex surgical procedures can be performed in the ambulatory setting. By reducing postoperative complications related to surgery (and anesthesia), patient care can be improved with reduced costs for the healthcare system.

1.1. Definition

Ambulatory surgery, also known as outpatient surgery, same-day surgery, day case, or day surgery is surgery that does not require an overnight hospital stay, meaning surgery patients may go home and do not need an overnight hospital bed. The purpose of the outpatient surgery is to keep hospital costs down, as well as saving the patient's time that would otherwise be wasted in the hospital. There are numerous benefits of such approach, which are as follows:

- **Convenience:** Usually, recovery at home is easier and more convenient than in-hospital recovery.
- **Lower cost**: With no in-hospital stay, standard hospital expenses (nursing, medications, food, hospital room expenses, etc.) per patient are much lower for outpatient surgery.
- **Reduced stress:** Given its predictable nature and distance from seriously ill patients, outpatient surgery is less stressful than inpatient surgery. Of course, that is especially true for children who are afraid of being away from their parents and home (hospitalism syndrome). Recovery at home also reduces stress in most people.
- **Scheduling:** No emergency surgeries and long and complicated procedures as in in-hospital setting make ambulatory surgery very predictable. With less complex and routine procedures, day surgery unit can generally maintain it schedule.

Ambulatory surgery centers also known as **ASCs** are modern healthcare facilities focused on providing same-day surgical care, including diagnostic and preventive procedures. Hernia procedures, as procedures of "low intensity and high frequency" are ideal for day surgery.

1.2. Historical perspective

Some of the first procedures in general anesthesia fall under what is now called a one-day surgery. Even in 1899, James H. Nicoll in Glasgow Royal Hospital for Sick Children in general anesthesia operated on children, of which 460 were cleft palate and lip, and these children were discharged same day.

In 1912, Ralph Waters based his Downtown Anesthesia Clinic in Iowa, which deal mainly with one-day surgery under general anesthesia. After these early pioneers, interest in one-day surgery was reduced to the 1950s of the twentieth century when centers for outpatient and day surgery started to open in South Africa, Canada, and the United States.

In 1994, about 60% of all surgical procedures in the United States were performed as one-day surgery. In 2001, depending on the hospital, in England and Wales, around 45% of procedures were performed as one-day surgery. The Ministry of Health of the United Kingdom estimates that up to 75% of surgical procedures could be performed in one-day surgery setting [1].

1.3. Patient selection criteria

Probably the most important difference of ambulatory from in-hospital surgery is home recovery with no nursing or medical assistance. Since that means the patient needs to manage

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himself in postoperative period, his cooperation is essential and his selection and education are very important for outpatient surgery success.

Patient assessment for day surgery falls into three main categories as follows.

1.3.1. Surgical criteria

The major factors that determine whether or not a given operation can be performed on a day case basis are as follows:

1. The degree of tissue damage, and hence pain

2. The extent of blood and fluid loss

3. The extent of postoperative care and complications.

Although arbitrary time limits have been suggested in the past, modern anesthesia allows acceptably rapid recovery after procedures lasting several hours. Therefore, operating time should not be a limit for one-day surgery.

After the operation is completed, there should be no continuing blood loss or requirements for fluid therapy and no need for complex postoperative care, which is difficult to provide in the community.

1.3.2. Social criteria

Although patients will not be discharged from the day unit until they are stable (see Section 5.5), one cannot say that they have completely recovered, especially because it may take several hours to completely regain precise motor control and fine judgment. Therefore, patient needs to have in company responsible and physically able adult person who can help them during first postoperative day, have phone line nearby and react and call for help in the case of complication.

Social factors are an increasingly common reason for excluding patients from day surgery. For example, single, elderly patients without caregivers, patients with little children, etc., but with adequate planning, lots of these limitations can be overcome.

Although surgery increases risk for thromboembolic events, there is no firm evidence to preclude long journeys or air travel, except in patients with risk factors for venous thromboembolism (VTE) who should consider graduated compression stockings and/or LMWH for flights longer than 6 h after day surgery [2].

Moreover, if rapid return to the hospital in case of emergency is not possible, facilities for emergency care must be available at the final destination.

1.3.3. Medical criteria

Selection of patients should be based on their overall physiological status and not governed by arbitrary limits such as age, weight, or American Society of Anesthesiologists (ASA) status.

For any pre-existing condition, the patient may have its nature, stability, and functional limitation should all be evaluated. The conditions should be under control and any medical treatment must be optimized. It is also important to ask whether the patient's management or outcome of the procedure would be improved by hospitalization. Unless this would be the case, surgery should take place in day surgery setting [3].

Regarding age of the patients, both medical and social problems tend to increase with age, but these should be considered independently, without any arbitrary upper age limit [4].

The American Society of Anesthesiologists (ASA) classification is a simple index of chronic health but it is far too nonspecific for use in day surgery settings. For example, patient with ASA III status experiences no more complications than patients with ASA grade I or II. While specific conditions should always be assessed on an individual basis, in general, patients of ASA grade I–III should be suitable for day surgery unless there are other contraindications. Even some ASA IV patients will be acceptable, provided their surgery produces minimal postoperative disturbance, as will often be the case when performed under local anesthesia [3].

Obesity is a challenge, but is not a contraindication in ambulatory surgery. In expert hands, even morbidly obese patients can be safely managed, of course, appropriate resources provided. It is well known that increasing BMI increases the incidence of complications during the operation or in the early recovery phase, but these problems would still occur in the case of in-hospital procedures and would have usually been successfully resolved by the time a day case patient would be discharged. Moreover, short-duration anesthetic techniques and early mobilization associated with day surgery benefit obese patients [5].

Patients with stable chronic disease such as diabetes, asthma, or epilepsy are often better managed as day cases because of minimal disruption to their daily routine.

2. Anesthesia

There are three categories of anesthesia available:

1. General anesthesia
2. Spinal or epidural anesthesia
3. Local anesthesia

For hernia repair, all three types of anesthesia are used. Choice of anesthesia primarily depends on expertise, traditions, and whether the institution has specific interest in hernia surgery. Because of that local anesthesia use varies in different countries, from almost 100% in specialized institutions, dedicated to hernia surgery to 18% in Denmark and a few percent in Sweden [6].

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2.1. General anesthesia

Theoretically, general anesthesia is ideal for the operator, providing patient immobility and muscular relaxation if required. Large, complex, or incarcerated hernias can be repaired in the confident knowledge that any unforeseen intraoperative difficulty can be dealt with. In addition, general anesthesia can be combined with regional anesthetics infiltration for better postoperative pain control [7, 8].

General anesthesia has, however, a number of disadvantages. Systemic and sedative effects of the anesthetic can delay recovery so an unplanned overnight stay needs to be provided. This type of anesthesia can result with postoperative nausea and vomiting (PONV) and urinary retention in elderly patients or in children who also prolong recovery. Of course, not negligible is the factor that the use of general anesthesia is significantly more expensive than local anesthesia [9].

The use of endotracheal tube (ET tube or ETT) has been a standard method of providing secure airway during general anesthesia. ET reliably provides a pathway from an outside source of air to the lungs, when placed correctly. ET makes easier to use and adjust ventilator and breathing parameters, deeper levels of anesthesia possible and offers good protection from aspiration and aspiration pneumonia. However, the use of ET is not without risks, such as failed intubation resulting in broken teeth, sore throat, injuries of lips, mouth or pharynx, and damage to vocal cords, can result in hoarse voice, exacerbation of asthma in susceptible people, increased or decreased heart rate, and changes in blood pressure due to nervous system effects, injuries of spinal cord, and even brain damage or death.

Introduction of the laryngeal mask airway (LMA) has been a revolutionary development in airway management over the last decades. It was used clinically in 1981 by A. Brain for the first time and has been widely used in Germany since 1990. Originally intended as a substitute for conventional mask respiration for short periods of general anesthesia, the laryngeal mask is in the meantime used in many areas as an alternative to elective endotracheal intubation as well as an option for controlling difficult airways. Advantages over endotracheal intubation that these devices offer make them excellent choice for outpatient anesthesia. Placement and management of LMA requires lower dose of anesthetic than an endotracheal tube. In addition, the use of neuromuscular blocking agents is rarely necessary; the incidence of airway morbidity is lower; and the use of LMA may facilitate faster recovery and earlier discharge of patients. Two limitations of LMAs are incomplete protection against aspiration of gastric contents and inadequate delivery of positive pressure ventilation. Newer variants of the original laryngeal mask airway as well as an array of other recently developed supraglottic airway devices (SGAs), which aim to address these limitations. Their utility and safety in specific patient populations (e.g., the morbidly obese) and during certain procedures (e.g., laparoscopic surgery) remain to be determined [10]. It is suggested that general anesthesia should be combined with ilioinguinal nerve block for better postoperative pain control and faster mobilization of patients [8].

2.2. Spinal or epidural anesthesia

Great intraoperative analgesia and relaxation can be achieved with spinal anesthesia. Local vasoconstriction in the inguinal and pelvic regions (compensation from lower limb vasodilation

as a result from sympathetic block) provides excellent operating conditions with dry operative field. However, spinal anesthesia may produce a prolonged duration of sensory and motor block, and arterial hypotension so discharge from hospital may be delayed. This has stimulated the development of alternative agents, including combinations of local anesthetics and opioids. Intrathecal opioids added to low-dose local anesthetics produce a synergistic effect without increasing the sympathetic block or delaying discharge. Attention to technique, reduction of dose, and addition of fentanyl to lidocaine result in effective spinal anesthesia with rapid recovery and a low incidence of significant side effects or complications [11, 12]. If the limb is protected and adequate support is available at home, patients may safely be discharged with some residual sensory or motor blockade. Of course, patients must receive written instructions about their behavior until normal power and sensation returns and explanations about nature and expected duration of the blockade.

2.3. Local anesthesia

Local infiltration of anesthetics with or without local nerve blocks and system sedation gives excellent intraoperative analgesia, and it is undoubtedly the method of choice for repairing uncomplicated primary inguinal hernias in most patients [13]. Because there is no motor block and no systemic effect (provided sedation has not been given in excess), mobilization is rapid, and the technique is thus ideally suited to ambulatory surgery. Furthermore, local anesthesia administered before the incision produces longer postoperative analgesia because local infiltration, theoretically, inhibits build-up of local nociceptive molecules and, therefore, there is better pain control in the postoperative period.

Today, lidocaine (that provides fast onset of anesthesia) in combination with bupivacaine (provides longer duration of anesthesia—up to 6 h) is anesthetics of choice in hernia surgery. Reduction in onset time has been reported with the addition of sodium bicarbonate 1 mEq per 10 mL of lidocaine [13, 14].

Recent efforts in decreasing concentrations of local anesthetics, reducing local and systemic toxicity, and prolonging their effect have resulted in encapsulation in liposomes, complexation in cyclodextrins, and to a little extent in gold nanoparticles. However, with the promising future of lipid nanoparticles application in biomedical fields, more multicenter clinical trials are needed to be carried out [15].

In spite of everything, local anesthesia is admittedly more demanding of the surgeon, requiring accurate sharp dissection and gentle handling of tissues. Moreover, teaching hernia repair to the trainee with an awake patient presents its own challenges, especially when application of most local anesthetics results in different degrees of local vasodilation, and, after administration of large doses, this contributes to the hypotension Local anesthetics must be respected alsoas central nervous system depressants, and they can enhance respiratory depression usually connected with opioids and sedatives. In addition, seizures provoking concentrations of local anestetics are lower if patient has elevated carbon dioxide in blood (hypercarbia) [14].

However, some patients are unsuitable for local anesthesia. It is certainly not suitable for patients with large inguinoscrotal, incarcerated, or complex recurrent hernias, for excessively obese patients, children, or for mentally impaired patients [7]. Although elderly or medically

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unfit patients may be ideal candidates for local anesthesia, they may be far from ideal for ambulatory surgery.

3. Preoperative preparation

Preoperative preparation (also known as preoperative assessment) consists of major components:

1. Education of patients and their caregiver about ambulatory surgery settings.
2. Information about planned procedures and postoperative care (important information should be given in written form)—which is helping patients to make informed decisions.
3. Identification of risk factors, optimization of patient's health condition.

Member of the multidisciplinary team, trained in preoperative assessment for ambulatory surgery, needs to prepare patients for day surgery.

Patients ASA grade I or II, younger than 70 years, with unilateral inguinal hernias are amendable for examination, assessment, and treatment in the same day. This is called one-stop (single-stop surgery) protocol. Such protocols are developed for reduction of patient visits to the hospital. Many more hernia repairs and other day case procedures could be carried out using similar protocols [16, 17].

3.1. Fasting

The European Society of Anesthesiologists (ESA) in its guidelines says that it is safe to consume:

- Clear liquids (water, clear tea, black coffee, mineral drinks, and clear fruit juice) up to 2 h before surgery. Milk in large quantities curdles in the stomach and acts like a solid, but smaller quantities are handled like other liquids and are safe.
- Solid food, up to 6 h before surgery.

An operation should not be cancelled or delayed just because the patient is chewing gum, sucking a boiled sweet, or smoking immediately before anesthesia administration, but above is based solely on effects on gastric emptying and nicotine intake (including smoking, nicotine gum, and patches) should be discouraged before elective surgery [18].

Regarding chronic medications, American Society of Anesthesiologists Committee prepared extensive list of medications that are allowed prior surgery [19]. Prophylactic antibiotics are not recommended in laparoscopic or open surgery, except in the presence of risk factors for wound infection based on patient (recurrence, advanced age, immunosuppressive conditions) or surgical (expected long operating times, use of drains) factors [7].

3.2. Thromboprophylaxis

According to the thromboembolism risk stratification of the latest edition of the American College of Chest Physicians (ACCP) guideline, deep venous thrombosis (DVT) risk is low,

less than 10% without thromboprophylaxis. For day surgery patients who undergo open or laparoscopic procedure, early mobilization and ambulation are preferred over routinely administered pharmacological thromboprophylaxis.

Of course, a detailed venous thromboembolism (VTE) risk assessment must be a routine practice. Using pharmacological prophylaxis (if bleeding risk is not increased) is justified in patients with VTE risk factor at the time of surgical procedure (for example, a previous episode of VTE) [20].

4. Surgical techniques

The choice of technique used in inguinal hernia repair depends on the following factors.

- **Patient condition:** Open approach under local anesthesia is maybe better choice in elderly patients or in patients in poor health who are too weak to safely have a general anesthesia.
- **Surgical experience:** Not all surgeons are experienced enough in laparoscopic surgery so they are prone to open hernia repair.

According to European Hernia Society, laparoscopic surgery is recommended in patients with bilateral or recurrent hernias after open surgery. Unilateral or recurrent hernias after laparoscopic surgery are eligible for open approach in local anesthesia, if possible [7].

Management of hernia sac during procedure depends of intraoperative findings.

In most cases, it recommended that the hernia sac should be left intact to avoid increase in postoperative pain [21]. In patient with ascites, resection of hernia sac leads to complications such as persistent leakage of ascitic fluid [22].

In addition, injury of the spermatic cord structures should be avoided. In prevention of ischemic orchitis, resection of the hernia sac is recommended with distal hernia sac left *in situ* in the case of large inguinoscrotal hernias. All patients should have long-acting local anesthetic wound infiltration for postoperative pain control [7].

According to traditional teaching, ilioinguinal nerve should be preserved at all times in fear of the supposed morbidity associated with cutaneous sensory loss or chronic groin pain that can follow injury of the nerve. However, most patients reported minimal morbidities following excision of ilioinguinal nerve. Moreover, ilioinguinal nerve excision is an effective and very well-documented treatment of chronic inguinal pain following hernia surgery. Neurectomy of ilioinguinal nerve during operation is associated with a lower incidence of chronic inguinal pain after the procedure according to newer retrospective studies [23].

Surgical experience needed for surgical procedures in ambulatory surgery is not properly specified. However, according to European Hernia Society guidelines, the learning curve for open Lichtenstein repair is shorter than for endoscopic inguinal hernia repair (especially totally extraperitoneal technique) which is between 50 and 100 procedures (the first 30–50 are the most critical). Careful patient selection and adequate surgical training might minimize the risks for possible serious complications in the learning curve of endoscopic surgery.

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Interestingly, there does not seem to be a negative effect on outcome when resident instead of surgeon performs an operation [7].

5. Postoperative management

5.1. Recovery

Recovery from surgery and anesthesia is divided into three parts:

1. **First stage:** Duration of the first stage ends when the patient is awake, pain is under control and with protective reflexes recovered. First stage of recovery should be spent in a recovery room with educated nurses—postanesthesia care unit (PACU). Most patients who undergo surgery with a local anesthetic block can bypass the first stage recovery area.
2. **Second stage:** Lasts until the patient is meeting postoperative discharge criteria. Second stage should be in premises near to the ambulatory surgery theatre. Of course, these premises need to be equipped and personnel need to be educated to deal not only with usual postoperative problems (pain, PONV) but also with emergencies (for example, cardiovascular events or hemorrhages). In addition, the anesthesiologist must be in contact to help with problems if they arise.
3. **Third stage:** Ends when the patient has made a full physiological and psychological recovery from the procedure. This may take several weeks or months from procedure.

Since the PACU is high dependency area and may contribute for a significant portion of the perioperative costs, efforts have been invested to develop strategies to skip first stage recovery area. These strategies are variously called fast track surgery.

Fast track surgery uses different techniques in the care of patients undergoing ambulatory procedures. That means the use of regional or spinal anesthesia, minimally invasive surgery, excellent control of pain, and fast rehabilitation (early oral nutrition and mobilization). This type of surgery shortens recovery time by reducing patient stress response and accompanying organ dysfunction.

Effectiveness of fast track surgery generally depends on three groups of factors as follows:

- **Preoperative factors:** Careful patient assessment and selection, careful explanation about the procedure, and what will happen at every stage of the perioperative pathway, including early mobilization and resumption of food and drink.
- **Intraoperative factors:** The use of regional anesthesia where possible, combined with minimal invasive surgery, avoidance of long-acting opioids, nasogastric tubes, and surgical drains. Intraoperative fluid therapy should be goal directed to avoid sodium or fluid overload, and attention should be paid to maintaining normothermia.
- **Postoperative factors:** Effective analgesia that minimizes the risk of PONV and allows early mobilization. Systemic opioids should be avoided where possible and regular oral

(or intravenous) analgesia with simple analgesics (paracetamol and NSAIDs) should be used. Hydration should be maintained with intravenous fluids but discontinued as soon as the patient returns to oral fluids, and PONV should be treated aggressively using a multimodal approach to therapy [5].

5.2. PONV avoidance and treatment

Postoperative nausea and vomiting (PONV) is frequent but distressing consequence of anesthesia. Incidence of PONV can be as high as 80% in high-risk patients with incidence of vomiting about 30% and nausea about 50% [24]. PONV can result in extended postanesthesia care unit (PACU) stay with unforeseen hospital admission so we see that PONV results in a significant increase in overall care costs.

Research in PONV risk factors started in the 1990s. The identification of PONV high-risk patients can reduce the number of potential candidates for prophylactic antiemetic pharmacotherapy, so reducing costs and antiemetic side effects for patients unlikely to benefit.

Several risk factors have systematically proved to be PONV-independent factors [25].

1. ***Patient-related independent factors***

- **Female gender**

  It is unclear why female gender is more prone to PONV, especially during menstruation and preovulatory phase of the menstrual cycle. Maybe because of sensitization of the chemoreceptor trigger zone (CTZ) and vomiting center to estrogen and follicle-stimulating hormone (FSH). This gender difference in PONV does not exist in children or patients older than 60 years.

- **Nonsmoking**

  Nonsmokers are almost twice as likely as smokers to have PONV. Chronic exposure to smoke produces changes in liver enzymes that may affect the metabolism of drugs used in the perioperative period and the ability of these drugs to produce PONV.

- **History of PONV, motion sickness, or migraine**

  Patients with previous history of PONV, motion sickness, or migraine are more likely to suffer from PONV.

- **Age**

  In pediatric age, the PONV rate is highest in the 6- to 10-year age group and then decreases with the start of puberty and further decreases with progressing age.

- **Obesity**

  A body mass index (BMI) of more than 30 in patients had been traditionally associated with PONV. Recent findings suggest that PONV risk is not in relation with increased BMI, but in patients with other risk factors, increased BMI may increase chance of PONV [26].

2. *Anesthesia-related independent predictors*

- **Use of opioids**

  Risk of PONV is almost doubled with the postoperative use of opioids. It appears to be more significant total dose than exact type of drug. If the patient already feels pain, the use of opioids does not significantly increase the chance of PONV.

- **Inhalational anesthetics and use of nitrous oxide (N_2O)**

  Volatile induction maintenance anesthesia (VIMA) is associated with lesser PONV than balanced anesthesia using opioids but with no differences in incidence of PONV among the individual volatile anesthetics. Avoiding N_2O, which has emetogenic effect, can lead to reduction in risk of PONV.

- **Duration of anesthesia**

  Increasing the operative duration by 30 min may increase the risk of PONV by 60%.

Although the type of surgery has been identified as a risk factor in numerous reports, its status is still somewhat controversial; the specific procedures implicated as particularly emetogenic sometimes vary among studies [25].

The risk of PONV should be estimated for each patient. No prophylaxis is recommended for patients at low risk for PONV. For patients at moderate to high risk for PONV, regional anesthesia should be considered. If this is not possible or contraindicated and a general anesthesia is used, a multimodal approach that combines pharmacologic and nonpharmacological prophylaxis to minimize risk of PONV should be adopted [25, 27].

Postdischarge nausea and vomiting (PDNV) defined from 24 h postdischarge up to 72 h has an incidence of up to 55% and it appears that it has different risk factors than those for PONV [27].

5.3. Postoperative urinary retention

Postoperative urinary retention (POUR), inability to void in the presence of a full bladder immediately after surgery, is relatively common and can occur in 0.2–25% of patients after inguinal hernia repair [28]. The widely varying reported incidence of POUR reflects its multifactorial etiology and the lack of uniform defining criteria. This complication leads to increased length of stay, increased discomfort, need for invasive catheterizations, and increased costs.

To minimize POUR risk, physician must be aware of preoperative risk factors such as age greater than 50 years, postoperative narcotic medications, concurrent neurologic diseases such as stroke, poliomyelitis, cerebral palsy, multiple sclerosis, spinal lesions, and diabetic and alcoholic neuropathy and over 2 h anesthesia duration [28–30].

History of benign prostate hyperplasia, unilateral versus bilateral hernia repair, body mass index, and laparoscopic hernia repair are also found significant in some studies [28, 31].

Bladder catheterization is the standard treatment of POUR and is recommended in high-risk patients for 24 h under adequate antibiotic prophylaxis. Low-risk patients can be discharged without voiding (see Section 5.5) [30, 32].

5.4. Postoperative management of pain

Postoperative pain experience is affected by multiple factors, such as the type of surgery, age, pain threshold, and expectations. Patients can experience postoperative pain for more than 3 days and have reduced quality of life for more than 7 days after operation [33].

Although many patients continue to experience pain and discomfort after discharge, 30–50% patients do not take adequate analgesia because of misunderstandings and insufficient information. For example, pain in elderly patients is often underrecognized and underassessed. It is important to understand that pain perception and threshold do not decrease with aging and that elderly patients influenced by their attitude and beliefs may refrain from reporting pain. To increase compliance, especially among elderly patients, patients with poor education and those without a strong social network, information on postoperative analgesia should be conveyed both verbally and in written form thus helping patients assimilate information.

The use of analgesics that provide effect with different mechanisms results in synergistic or additive analgesia. That allows lower doses for each of analgesics, so diminishing side effects. Multimodal remains the recommended approach for pain management [34]. Of course, obvious measures to minimize postoperative pain include minimally invasive surgical techniques and the use of regional and spinal anesthesia. Reliance on long-acting opioids may exacerbate PONV and delay recovery and discharge.

Choice of analgesics

- **Paracetamol:** Paracetamol (also available in combination with opioids) is an analgesic with few side effects but with a desired opioid-sparing effect (when a nonopioid is combined with an opioid, the opioid dose can be lowered without compromising pain relief). Oral paracetamol is 80–90% absorbed from the gastrointestinal tract and displays peak plasma concentration within 30–60 min with onset of pain relief after 5–10 min. However, there is a possibility of higher risk of toxicity from intravenous paracetamol in patients with renal or hepatic insufficiency.
- **NSAIDs:** Nonsteroidal anti-inflammatory drugs (NSAIDs) have an established role as effective analgesics for day-case surgery and can, provided there are no contraindications, be prescribed to all patients. To allow time for strongest analgesic effect, NSAIDs need to be use either preoperatively or early during surgery because of slower start of analgesia in comparison with opioids. Use of nonselective NSAIDs or the more selective COX-2 inhibitors in the first 3 postoperative days has been shown to produce adequate analgesia, reduce the need for opioids, and facilitate a faster recovery compared with opioid-based analgesia. Additionally, studies indicate synergistic effects on opioid reduction when paracetamol and NSAIDs are prescribed together [34].
- **Opioids:** Opioids such as fentanyl or morphine can be used for moderate-to-severe pain in the PACU setting. However, incidence of PONV is significantly higher in patients who received opioids and higher in patients who received morphine instead of fentanyl. Other side effects of opioids are sedation, constipation, pruritus, respiratory depression, and urinary retention. A reliance on opioids for perioperative pain management may even cause acute opioid-induced hyperalgesia in some patients. Therefore, multi-modal analgesia is preferable and use of long-acting opioid is discouraged [34].

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- **Ketamine:** This N-methyl D-aspartate (NMDA) receptor antagonist provides significant opioid-sparing effects that can be long lasting. Low doses (0.1–0.15 mg/kg) make it possible to achieve this desirable analgesic outcome without the significant adverse effects, such as dissociation and hallucinations [35]. However, one must be careful because the known side effects, such as hypotension, bradycardia, postoperative dizziness, and sedation, can occur thus delaying mobilization and discharge [34].

5.5. Discharge

As mentioned in Section 5.1, there are three stages of recovery. With patient discharge from hospital, second stage of recovery is completed. Patient is fit for discharge when meets discharge criteria that can be medical and nonmedical.

Medical criteria are as follows:

- Stable vital signs
- Orientated to preoperative stage
- Minimal nausea and vomiting
- Controllable pain
- No significant bleeding having regard to the procedure.

Nonmedical criteria are as follows:

- An adult to accompany the patient home and to be with them at home for the first 24 h following surgery.
- Access to a functioning telephone at home.

Physicians experienced in outpatient surgery can use their knowledge and experience to decide when a patient has recovered sufficiently for discharge. Common anesthetic reasons for hospital transfer were inadequate recovery, nausea and vomiting, hypotension, and syncope. Surgical reasons for hospital transfer included bleeding, extensive surgery, perforated viscus, and further treatment. The decision to discharge a patient after day surgery is a major decision because postoperative care and assistance needs to be provided as if the patient is in a long-term hospital stay. Because of that, the use of an objective evaluation system for safe discharge is essential. Post Anaesthetic Discharge Scoring System (PADSS) was developed by Chung et al. at the Toronto hospital, where it has been used extensively to determine when patients can be discharged home safely and it has proved to be a reliable guide [36]. PADSS considers five criteria: vital signs, ambulation, nausea/vomiting, pain, and bleeding. Requirements to drink and void have been removed from newer version of PADSS [32].

5.6. Follow-up

Most surgeons ask that their patients to return in about a week for a follow-up visit. At this time, all stitches will be removed and patient will receive further instructions regarding behavior, workload, etc. To further reduce patient time and expense for travel and free clinic

time for new patients, some institutions tend to substitute the standard postoperative clinic visit with telehealth where patients are contacted via telephone, and stitches are removed at their GP office [37, 38].

6. Conclusion

Hernia repair in ambulatory surgery center is a trend that is rapidly evolving and it is logical to expect a further increase in the number of operations, as well as the variety of surgical procedures in these settings. Despite the enormous progress in the field of one-day surgery, there is still room for further reduction in postoperative pain, potential to speed-up recovery of patients with further lowering the costs of treatment(s).

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