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Pain management methods after laparotomy

A descriptive literature review

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Abstract

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Pain can be a physical or a psychological experience. Everybody experiences pain at some point in their life. Pain can be categorized into acute or chronic pain. Furthermore, pain management methods can be divided into pharmacological and nonpharmacological. After surgery, efficient pain management is vital as it promotes mobilization and enables faster recovery in general.

The purpose of this thesis is to describe how pain is managed after a laparotomy and compare different pain management methods as well as their advantages and disadvantages. This thesis aims to give information on different pain management methods to healthcare professionals working with patients who have undergone laparotomy.

Data was collected using CINAHL and Medline databases. The Finnish database Medic was also used but no viable results were found through that. A manual search was also done and at the end, 9 articles were selected after applying the set inclusion and exclusion criteria. The selected articles were analysed using inductive content analysis. The research question set for this thesis was "What are the advantages and disadvantages of different pain management methods used after laparotomy?"

The data analysis showed that a patient-controlled analgesia (PCA) pump has the most advantages and least disadvantages as a pain management method after a laparotomy. These advantages included that several medications and combinations can be given via PCA pump, and the patient can be administered continuous infusion, bolus doses, or both if desired. If the patient is unable to comprehend how the pump is used, it can act as a disadvantage.

The results of this thesis can be utilized by healthcare professionals who work with patients who have undergone a laparotomy or are experiencing abdominal pain. Limitations of this thesis included the difficulty in finding research material as well as limited information on nonpharmacological methods.

Key terms: pain, pain management methods, laparotomy

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Kipu voi olla fyysinen tai psykologinen kokemus. Jokainen kokee kipua elämänsä aikana. Kipu voidaan jaotella akuuttiin ja krooniseen kipuun, lisäksi kivunhoitomenetelmät voidaan jakaa lääkkeellisiin sekä lääkkeettömiin kivunhoito menetelmiin. Leikkauksen jälkeen tehokas kivunhoito on elintärkeää koska se edistää nopeampaa liikkeelle lähtöä sekä nopeampaa toipumista.

Tämän opinnäytetyön tarkoituksena on kuvailla, kuinka kipua hoidetaan laparotomian jälkeen, vertailla erilaisia kivunhoitomenetelmiään keskenään sekä tutkia niiden hyötyjä ja haittoja. Tavoitteena on antaa informaatiota erilaisista kivunhoitomenetelmistä hoitotyön ammattilaisille jotka työskentelevät laparotomia leikattujen potilaiden parissa.

Tiedonkeruussa on käytetty CINAHL ja Medline tietokantoja. Myös Medic tietokanta käytiin läpi, mutta sieltä ei löytynyt tuloksia, joita olisi voitu hyödyntää opinnäytetyössä. Artikkeleita etsittiin myös manuaalisesti. Sisäänotto ja poissulku kriteerien jälkeen lopulliseen työhön valikoitui yhdeksän artikkelia. Valitut tutkimukset analysoitiin käyttäen induktiivista sisällön analyysia. Opinnäytetyön tutkimuskysymys on ”mitkä ovat eri kivunhoitomenetelmien hyödyt ja haitat laparotomia leikatuilla?”

Tutkimusten analysointi näytti, että kipupumpussa on eniten hyötyjä sekä vähiten haittoja laparotomia leikattujen potilaiden kivunhoidossa. Hyötyihin lukeutuu muun muassa eri lääkkeiden ja niiden kombinaatioiden antaminen kipupumpun kautta sekä jatkuvan infuusion tai bolus eli kerta-annosten antaminen haluttaessa. Ainut haitta mitä pystyi tutkimusten perusteella määrittämään on, jos potilas ei kykene ymmärtämään miten kipupumppua käytetään.

Tämän opinnäytetyön tuloksia voidaan käyttää niiden hoitotyönammattilaisten toimesta, jotka tekevät töitä potilaiden parissa, jolle on tehty laparotomia tai kärsivät vatsanalueen kivuista. Opinnäytetyön kirjoittamisen aikana rajoituksiksi nousi luotettavan materiaalin saatavuus sekä vaikeus löytää tutkimuksia lääkkeettömien kivunhoitomenetelmien käytöstä.

Avainsanat: Kipu, kivunhoito menetelmät, laparotomia

Tämän opinnäytetyön alkuperä on tarkastettu Turnitin Originality Check -ohjelmalla.

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1 Introduction

Everyone experiences pain at some point in their life. Most simple pain can be categorized as acute and chronic pain; it can also be psychological or emotional. Pain is described as an unpleasant sensory or emotional experience. (Käypähoito, 2017).

There are still flaws in pain management in general as everyone experiences pain in such an individual way. The topic for this thesis is “Pain management methods after laparotomy”. Whether you work in an emergency room, surgery, or surgical ward you can and most likely will encounter patients who suffer from abdominal illnesses and thus also pain. Pain treatment is important as we all experience pain at some point in our life and it can affect our overall wellbeing.

The purpose of this thesis is to describe how pain is managed after laparotomy as well as compare different pain management methods and their advantages and disadvantages. This thesis aims to give information on different pain management methods to healthcare professionals working with patients who have undergone abdominal surgery. But can also be utilized by healthcare professionals who work with patients who suffer from abdominal pain in general.

2 Key terms

Key terms determined for this thesis are pain, pain management methods and laparotomy. These words are used throughout the text to make it coherent and easier to follow.

Pain is a signal that tells our brain that something is hurting. The brain communicates with the rest of the body signalling that something is wrong. Experiencing pain and how it manifests varies within individuals and is something that everyone experiences during their life for example during labour, fracturing of a bone, stomach- or headache. (National institute of neurological disorders and stroke, 2023)

Four major processes happen in a person’s body when they experience pain: transduction, transmission, modulation, and perception. (Osterweis et al., 1988, pp.123–128). In the transduction phase, a tissue-damaging stimulus is transformed into a signal that via the central nervous system is perceived as pain. (McEntire et al., 2016). During the

transmission phase, the message is delivered to the brain which processes the information. Modulation happens almost simultaneously with transmission meaning that the body alters the pain signal as it is being transmitted. (Kirkpatrick et al., 2015). Perception of pain means the cognitive and emotional influence of the experience, meaning how a person reacts to the pain and experiences it. (Asmundson, 2022, pp.225–251)

Pain can be divided into acute and chronic pain. Acute pain is sudden in onset and can emerge in various situations. (Terveyskylä, 2019a). Pain becomes chronic when it lasts longer than three months. Chronic pain can be caused by, for example, tissue or nerve damage. (Heiskanen, 2022). Nociceptive pain means pain caused by tissue damage, often caused by the activation of pain receptors due to tissue damage, for example after surgery. Nociceptive pain can be further divided into neuropathic (nerve) and visceral (originating from internal organs) pain. (Käypähoito, 2017).

Pain management is the process provided that reduces or alleviates pain. (Conrad Stöppler, 2023). There are several different pain management methods which can be categorized as pharmacological and non-pharmacological methods. To get the most comprehensive effect the two methods are often combined.

Pharmacological pain management is aimed to relieve pain and to enable the regular use of non-pharmacological interventions. The selection of correct pain medication is affected by for example the intensity of pain, nature of it, and adverse effects. Patients' medical history should also be taken into consideration. (Heiskanen, 2022).

One of the most effective and common non-pharmacological methods is physical therapy, it aims to promote mobility, functional ability, and rehabilitation. Pivotal methods in physical therapy are guidance, therapeutic training, manual therapy, and mobility aids. (Korpi, 2022). Other non-pharmacological methods are relaxation exercises, music, reading, and hot and cold treatments. (Terveyskylä, 2018)

Laparotomy is defined as a surgical incision into the abdominal cavity. (Oxford Languages, 2023) As simple as it can be put it is cutting one's abdomen open. (Duodecim terveyskirjasto, 2021). A laparotomy is done for various reasons although indications for it have been reduced since less invasive procedures have become more common. In cases where a person might have severe adhesions from previous surgeries, distended intestines, obstruction or for example a large tumor that cannot be operated laparoscopically a surgeon might have to result in a laparotomy. (Rajaretnam, Okoye and Burns, 2019)

3 Background

A laparotomy is performed under various situations and is a relevant part of gastrointestinal surgery. In a laparotomy the peritoneal cavity is opened, thus giving the surgeon a way to explore what might be wrong and treat the problem at hand. Cutting the abdomen open is a big operation as the incision cuts through skin, adipose tissue, fascia, and muscle. Recovery post-operatively can be difficult and painful. As everyone is an individual, what works for someone might not work for the other person thus having different analgesic methods is important. (Cleveland Clinic, 2023)

Laparoscopic surgeries are less invasive procedures. In a laparoscopic procedure, a small incision is made, and a scope is inserted into the abdomen. This is the preferred method as it has fewer complications and faster recovery. (Wang et al., 2022)

Enhanced recovery after surgery or fast track surgery recovery is aimed at re-examining traditional practices and replacing them with evidence-based practices as well as comprehensively covering the whole perioperative process. (ERAS society, 2023)

Furthermore, the enhanced recovery after surgery (ERAS) program is based on developing knowledge in surgery, aiming to optimize the recovery process. Studies have shown the benefits which include fewer complications, faster recovery postoperatively, and going home sooner. (Savikko, Kössi and Scheinin, 2016)

3.1 Anatomical perspective

The oral cavity, pharynx, esophagus, stomach, small intestine, large intestine, and anal canal along with teeth, tongue, salivary glands, liver, gallbladder, and pancreas create the human gastrointestinal tract (GIT). Digestion of food, absorption of nutrients, and excretion of waste products are a few of the gastrointestinal tract's main functions. (Ogobuiro and Tuma, 2019)

Gastrointestinal surgery treats a variety of diseases and illnesses, for example, cancers that incidence within the GI tract, appendicitis, bowel perforations, and hernias. (HUS, 2023) Some other conditions that might require surgical intervention are traumatic abdominal injuries, gastrointestinal bleeding, or infections. (Cleveland Clinic, 2023)

3.2 Pain assessment

Pain assessment after surgery is important as the aim of pain management is to reduce the negative factors related to acute surgical pain. The secondary aim is to enable the patient to function as normally as possible and return to normal function as soon as possible. (Horn and Kramer, 2022)

Pain can be assessed using pain scales. There are multiple scales for different reasons. Patients are usually given the chance to choose a pain scale that they feel the most comfortable using. Different scales are for example numeric rating scale (NRS), verbal rating scale (VRS), and visual analog scale (VAS). These are the most used scales in Finland. (Salanterä et al., 2013)

3.3 Pain management methods

Efficient pain management after surgery is vital as it promotes early mobilization and enables faster recovery in general. Pain management includes physical but also cognitive methods. Physical methods are non-pharmacological methods, for example, acupuncture, massage, and hot or cold treatment. (Salanterä et al., 2013)

After abdominal surgery, there is the possibility of temporary constipation or ileus. The use of opioids can cause constipation; thus, the use of opioids should be avoided after abdominal surgeries. Epidural infusion, local analgesia, or wound catheter are more optimal and have fewer adverse effects. (Kontinen and Hamunen, 2015)

3.3.1 NSAIDs

Nonsteroidal anti-inflammatory drugs (NSAIDs) are most used and prescribed for pain to relieve it, reduce inflammation, and reduce temperature. NSAIDs come in different forms, for example, creams, gels, tablets, capsules, oral liquids, and suppositories thus they can be used from infants to adults. Most common NSAIDs are ibuprofen, aspirin, and naproxen. (NHS, 2022)

3.3.2 Opioids

Opioids are drugs that work through the central nervous system (CNS) and are often prescribed after surgery since they are efficient. Opioids come in all forms such as tablets, intramuscular injections, intravenous injections, and oral suspensions. There are

many adverse effects of opioid usage, including nausea and vomiting, constipation, and drowsiness in addition opioids are highly addictive. (Terveyskylä, 2019c)

3.3.3 Epidural catheter and infusion

A small catheter is put outside of the dura mater. This is called an epidural, it is mostly used for post-operative pain management, during childbirth, and in the treatment of prolonged cancer pain. Through an epidural catheter, it is possible to administer continuous pain management or in intervals otherwise known as bolus doses.

A numbing agent is put into the epidural catheter. It is possible to use for example lidocaine, bupivacaine, and ropivacaine. Furthermore, to add an opiate into the numbing solution to enhance the pain management effect. The opiate commonly used in Finland regarding epidural infusions is fentanyl. (Tuominen, 1995)

There are adverse effects in epidural and that is why a patient who is receiving pain management through it must be monitored regularly. The most common adverse effects are that only half of the operated area is numbing or not at all, and lower limbs can get numb thus patient might have difficulty walking especially if the insertion of the epidural fails and the catheter is introduced into the spinal space. If the infusion is running at a high rate, it can cause itching, nausea or vomiting, and fatigue. (Terveyskylä, 2019b)

3.3.4 Transversus abdominis plane block

Transversus abdominis plane (TAP) is a form of pain management where numbing is inserted directly into the operated area. It is designed to block the nerves supplying the anterior abdominal wall. TAP usually lasts for 24 hours postoperatively. It reduces the need for opiates and offers more effective pain management, there are minimal contraindications to TAP. (Wiisanen, 2023)

Two different types of TAP blocks exist, single-shot TAP block and continuous TAP analgesia via catheters placed into either the subcostal or posterior planes. The subcostal plane is more efficient in upper abdominal surgeries where the incision often is between T6 and T10 dermatomes. The posterior plane is a better choice in lower abdominal surgeries, where the dermatome is between T10 to L1 level, however, studies have shown that TAP block is not efficient in providing postoperative analgesia beyond

the T10 dermatome and might demand top-up analgesia via the oral route or e.g., patient-controlled analgesia (PCA) pump.

In continuous TAP analgesia two catheters are placed either in the subcostal or posterior plane and then connected with a Y connector. Via infusion pump numbing analgesia can be infused at a steady rate. (Niraj et al., 2015)

3.3.5 Rectus sheath catheter

A rectus sheath catheter (RSC) is inserted into the posterior rectus sheath before the surgery ends while the patient is still under anesthesia. Infusion of local anesthetic provides effective post-operative pain management while reducing opioid usage. Adverse effects can include local anesthetic overdose, liver hematoma, and bowel injury; however, complications are rare among RSCs.

3.3.6 Patient controlled analgesia

Patient-controlled analgesia (PCA) pump is used to treat acute or chronic pain and is efficient in providing postoperative analgesia. As it says in the name, patient-controlled analgesia is operated by the patient. Analgesia can be administered via intravenous, epidural, peripheral, or transdermal routes. Multiple different drugs can be given via PCA e.g., morphine and oxycodone.

Specifically tailored dose of analgesic can be programmed to the device, for example, 3 mg of oxycodone/1 dose. After the patient administers the dose, a set lockout time can be put e.g., 5 mins after which the patient can again administer the set dose.

Some contraindications for PCA use are, the patient's unable to understand the concept, allergic reactions to the selected drug, or burns or trauma in the placement area. (Pastino and Lakra, 2023)

3.3.7 Non-pharmacological methods

Non-pharmacological pain management methods are pain interventions that do not involve the use of drugs. The main goals of non-pharmacological pain management are to reduce pain, and anxiety and to provide a sense of control to the patient. The advantage of non-pharmacological methods is that they are safe and cost-effective. They can be divided into physical and psychological interventions. (El Geziry et al., 2018)

4 Purpose, aims, and research question

The purpose of this thesis is to describe how pain is managed after a laparotomy as well as compare different pain management methods and their advantages and disadvantages.

This thesis aims to give information on different pain management methods to healthcare professionals working with patients who have undergone laparotomy. This thesis can be also utilized by healthcare professionals who work with patients who suffer from abdominal pain in general.

Research question:

1. What are the advantages and disadvantages of different pain management methods used after laparotomy?

5 Methodology and methods

The methodological approach used in this thesis is qualitative and the method used is a descriptive literature review. Inductive content analysis is utilized to form the results. Methodology is a system of methods used in a particular area of study or activity. (Cambridge Dictionary, 2019)

Research methodology as its most basic form aims to answer the following: Why a study is being done, what methods have been used to define the research problem, what data has been collected, and what method is being used to analyze the collected data. (Goundar, 2011, pp.1–47)

5.1 Qualitative approach

There are three main approaches to conducting a literature review, qualitative, quantitative, and mixed methods. The methodology is chosen based on the aim of the literature review. (Snyder, 2019) The methodology chosen for this thesis is the qualitative method via descriptive literature review.

Qualitative research is a method where data is collected not by statistical analysis but using a naturalistic approach, that seeks to understand phenomena concerning people's lives, stories, and behavior, such as those linked to health, organizational function, social movements, or interpersonal relationships. It is done by researchers e.g., in social sciences. (Cypress, 2015)

In qualitative research, validity refers to the appropriateness of the tools, processes, and data. It is important to determine whether the research question and chosen methodologies are valid for answering the research question, whether the design meets the methodology, whether the sampling and data analysis is appropriate, and whether the results and conclusions are valid for the sample and context. (Leung, 2015)

5.2 Data collection

After the final research question had been formed, some initial searches were done through different databases to see what studies were available that would support the thesis topic. After those searches were done and when the research question was finalized, more specific data collection commenced on which the thesis could be based. The databases used to collect the data were CINAHL, Medline, and Medic.

PICO method is used to narrow down the subject and form the research question. (Hoitotyöntutkimus säätiö, 2019)

Table 1. Pico used to form the research question for this thesis.

P -> patient group	Adults who have had a laparotomy
I -> interest	Pain management methods
Co -> context	Hospital environment

5.2.1 Inclusion and exclusion criteria

Whilst doing the database searches, inclusion and exclusion criteria were used to narrow down the articles but also to rule out non-eligible results.

Table 2. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Adult patients who have had a laparotomy Gynecological operations Published 2015 onwards English or Finnish language Answers the research question	Pediatric patients Other languages Dissertation or literature review Published before the year 2015 Does not answer the research question

5.3 Data search and selection

When the database search was done the Boolean search phrase technique was used. Using the key terms determined throughout the process (pain, pain management methods & laparotomy) as well as synonyms of the set key terms, separating the phrases with AND, OR conjunctions.

Table 3. Database search results and article selection

Database	Search terms	Number of hits	Selected based on title	Selected based on abstract	Selected based on whole text
CINAHL	pain management OR pain relief OR pain control OR-pain reduction AND laparotomy OR abdominal surgery	n = 791	n = 101	n = 15	n = 4
Medline/Pubmed	pain management OR pain relief OR pain control OR-pain reduction AND laparotomy OR abdominal surgery	n = 743	n = 88	n = 10	n = 5
Medic	"kivunhoito" "kivunlievitys" "kipu" "laparotomia"	n = 4	n = 2	n = 1	n = 0
Total		n = 1538	n = 193	n = 26	n = 9

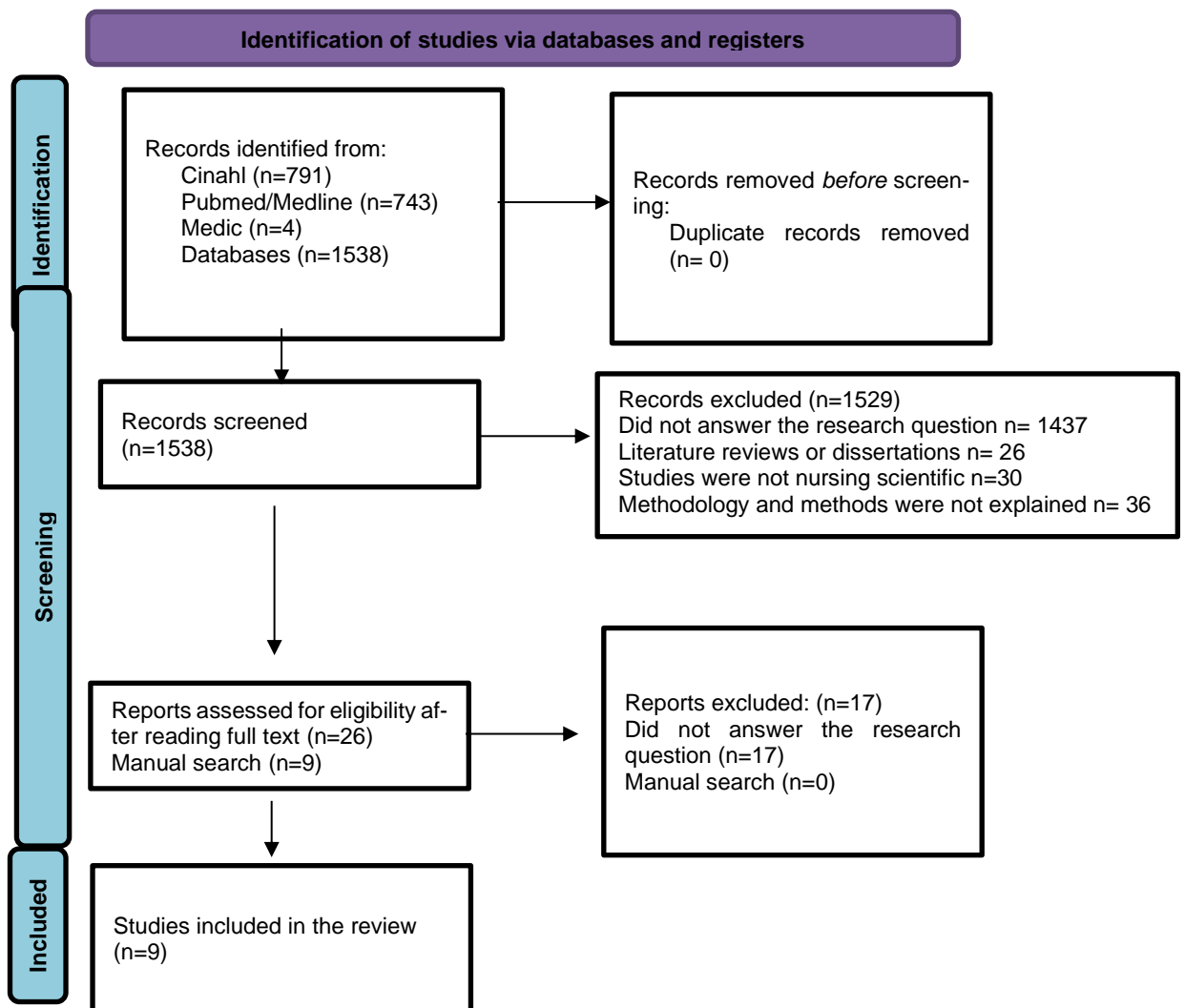


Figure 1. Prisma flow diagram

5.4 Data analysis

Content analysis as a method aims to systematic and objective description of phenomena and can be categorized into inductive and deductive analysis. The inductive method is used when there are no previous studies on a certain subject or the data is fragmented thus one of the key points in the inductive analysis are categories which help the researcher to organize data, provide meaning, and to generate knowledge on the topic. (Elo and Kyngäs, 2008)

In this thesis, the inductive method is used as a tool to analyze data since several different articles are being used, and the data as well as findings are fragmented between different studies.

Inductive content analysis (ICA) is one of the qualitative content analysis methods that aims to produce an understanding and an overall summary of the chosen topic. One important attribute that ICA has is coding the data. The data is coded by dividing it into categories and sub-categories. The data coding is specific to the topic that is being analyzed as the aim is to discover new understanding and answers to the set research questions. (Vears and Gillam, 2022)

The data was collected and categorized into a main category that was based on the set research question. The research question was “What are the advantages and disadvantages of different pain management methods after laparotomy?”. The main category was divided into two generic categories and further on into subcategories. (Table 4 and Appendix 2).

Table 4. Initial data analysis

Subcategories	Generic categories	Main category
Opioids Epidural Transversus abdominis plane (TAP) Rectum sheath catheter NSAIDs Patient controlled analgesia (PCA)	Pharmacological methods	Advantages and disadvantages of different pain management methods
Mobilisation Aromatherapy Breathing excersises	Nonpharmacological methods	

After initial data analysis was completed as described above, the generic categories were changed into main categories allowing for a more thorough analysis. This allowed the full content of the articles to be analyzed.

Table 5. Example of further data analysis

Sub-category:	Generic category:	Main category:
<p>Advantages:</p> <p>Effective in pain management</p> <p>Easily accessible</p> <p>Comes in different forms (per os, intramuscular, intravenous, oral suspension)</p> <p>Disadvantages:</p> <p>Several contraindications and adverse effects, nausea & vomiting, constipation</p>	Opioids	Pharmacological methods

Further data analysis (Table 5) was done similarly to all pharmacological and nonpharmacological methods identified from the articles. (Appendix 2).

6 Outcomes

6.1 Summary of the data

This descriptive literature review included nine studies which were conducted between the years of 2015 and 2023. In table of selected articles (appendix 1) all the participants were patients of whom most had undergone a laparotomy. Some of the patients

had undergone a laparoscopic surgery. Those results were not taken into consideration and were excluded. Patients who were studied in the selected articles varied in age, sex, and background.

The chosen articles included one qualitative study and eight quantitative studies. Qualitative study (Niraj et al., 2015). Quantitative studies chosen included (Aweke et al., 2020), (Falk et al., 2021), (Han et al., 2018), (Huepenbecker et al., 2019), (Naumann et al., 2022), (Stallings Welden et al., 2021), (Joseph and Devi 2023) and (Young et al., 2020).

The studies were conducted in various countries around the world. Three of the studies were done in the United Kingdom (Falk et. Al., 2021, Niraj et al., 2015 & Naumann et al., 2021), Two studies done in United states of America (Huepenbecker et al., 2019 & Stallings et al., 2021). The remaining four studies were all done in different countries. (Joseph & Devi 2023) in Bangalore, (Young et al., 2020) in Australia, (Han et al., 2018) in China and (Aweke et al., 2018) in Etiopia.

Furthermore Niraj et al., (2015) studied the effects and differences between four quadrant abdominis plane (TAP) block and continuous transversus plane analgesia. N=124 patients were included, and they all received continuous analgesia via TAP catheters. N=70 of those patients underwent a laparotomy. N=54 had laparoscopic surgery thus those were excluded from the analyzation of the results.

Naumann et al., (2021) conducted a study on rectus sheath catheter analgesia following major laparotomy. The study was done in 2021 in the United Kingdom. The method of the study was a retrospective observational study. N=911 patients participated in the study, a rectus sheath catheter (RSC) was applied to 30.3% (n=276) of patients, and the rest 69.7% (n=635) were without RSC. The effectiveness of epidural analgesia and PCA pump was studied by Falk et al., (2021) in a prospective multicentre study, n=221 patients were included in the study, and they were randomized into epidural (n=110) and PCA (n=111) groups.

Two studies were done in the United States of America. Huepenbecker et al., (2019) studied comparing the effects of epidural infusion. Their retrospective cohort study included n=561 patients, n=305 with an epidural and n=256 without an epidural. The epidural group had an infusion of bupivacaine 0.1% at an infusion rate of 6ml/h. Stallings et al., (2021) conducted a randomized controlled trial on the effects of aromatherapy for

pain management after abdominal surgery. N=172 patients participated, n=147 completed the study. They were furthermore divided into a group that received standard care (n=80) and an aromatherapy (AT) group (n=67).

A prospective randomized double-blinded multiple-centre clinical trial on the effects of oxycodone and sufentanil was done by Han et al., (2018) in China. N=175 patients were included in the trial, and n=87 received oxycodone via PCA pump. A bolus dose for laparotomy patients was 2mg without a background infusion. The Sufentanil group (n=88) received 2 micrograms as a bolus dose when needed as well and they had a background infusion of sufentanil 2ml/h.

Young et al. evaluated the differences between intrathecal morphine (ITM) and patient-controlled analgesia (PCA) versus PCA pump alone after colorectal surgery. This study was done in 2020 in Australia. Overall n=283 patients were selected and divided into the ITM+PCA group (n=163) in which 52% underwent laparotomy and PCA only (n=120) group in which 42% underwent laparotomy.

Joseph and Devi (2023) did a study about optimizing postoperative recovery after elective abdominal surgery using the multimodal technique. The study took place in Bangalore in 2023. The study was conducted using a quasi-experimental, posttest-only control group design. Both experimental and control groups had n=30 patients in them.

Patients in the control group received standard care according to hospital policy. For the experimental group, a set of deep breathing, coughing, positioning, and a set of leg and foot exercises were demonstrated. Both groups received paracetamol regularly after surgery. Pain was assessed using a numeric rating scale.

Aweke et al. (2018) compared the differences between three different paracetamol combinations in a randomized control trial study done in 2018 in Ethiopia. The study aimed to compare the effectiveness of paracetamol, paracetamol-tramadol, and paracetamol-diclofenac in postoperative pain management.

N=63 patients in total were selected and divided into three control groups. Paracetamol group (n=21), paracetamol + diclofenac group (n=21) and paracetamol + tramadol group (n=21). The effectiveness was measured by a numeric rating scale.

It was learned that the time to first request pain medication was shorter in the paracetamol-only group compared to the other two groups and that total tramadol consumption

was lower in those groups compared to the paracetamol-only group. The paracetamol + tramadol combination was superior to the other two in pain management. (Aweke et al., 2018)

One study was done in Australia by Young et al. (2020). They studied the use of intrathecal morphine in postoperative analgesia for colorectal cancer surgery. They included patient-controlled analgesia (PCA) pumps in their studies and compared the two methods.

In summary, pharmacological methods are the most effective in managing post-operative pain after laparotomy. Opioids should be avoided as they have different disadvantages including nausea and vomiting as well as causing constipation in high doses. The use of epidural infusion is shown to decrease opioid use as well as post-operative pain thus enabling the patient to recover faster. Patient-controlled analgesia was shown to be effective as well. Nonpharmacological methods are effective as a complementary treatment together with pharmacological methods but are not effective on their own in providing pain management after a laparotomy.

6.2 The Advantages and disadvantages of pharmacological methods

According to the studies epidural analgesia has become a valuable and important tool in managing post operative pain. Enhanced recovery after surgery (ERAS) protocol has studied the use of epidural extensively. The main advantages found through those studies is that epidural analgesia decreases opioid usage heavily as well as decreases post operative pain in general (Huepenbecker et al., 2019: 357).

The epidural group in (Huepenbecker et al., 2019) study received 0.1% bupivacaine at an initial rate of 6ml/h. If needed it was titrated so that the patient's pain was under control. The mean duration of epidural infusion was 1-3 days after which the patient received analgesia orally (Huepenbecker et al., 2019: 357).

This study stated clear advantages of the use of an epidural catheter which included lower pain scores in the post-recovery unit as well as later in recovery, opioid consumption was significantly lower, and recovery faster thus going home sooner. Intraoperatively, the epidural group had longer operative time and more hypotension which required vasopressors to treat. Hypotension was also more common in the epidural group postoperatively. The epidural group also had to keep the urinary catheter

longer and might have experienced urinary retention more often compared to the control group which is a clear disadvantage (Huepenbecker et al., 2019: 358–359).

(Falk et al., 2021) reported similar findings and advantages in their study about the effectiveness of epidural analgesia in postoperative pain management. Epidural analgesia was found to reduce stress response and promote earlier recovery as well as decrease oral opioid use (Falk et al., 2021: 68–69).

Four studies reported the benefits of patient-controlled analgesia devices (Young et al., 2020: 404; Han et al., 2018: 3-5; Falk et al., 2021:68-70; Huepenbecker et al., 2019:357-358). Several advantages were identified in the use of patient-controlled analgesia which included, PCA being versatile as several medications can be given via PCA, placement is easy and requires intravenous or subcutaneous cannula, the patient can operate pump on their own and continuous infusion as well as bolus doses can be given through the pump as well as it can be given together with for example transversus abdominis plane block or epidural infusion. The studies revealed no other disadvantages to the use of PCA pump than if the patient is unable to comprehend or understand how to operate the pump its use can be contraindicated.

Levobacaine and bupivacaine 0.375% were given into single shot transversus abdominis plane (TAP) block. Based on the results it was unable to provide effective analgesia post-operative on its own as the analgesic effect only lasts as long as the anesthetic agent. (Naumann et al., 2022: 346) and required a PCA pump if the T10 dermatome was crossed (Niraj et al., 2015: 580-581). For the continuous TAP infusion, two catheters were connected and attached to an infusion device that had bupivacaine 0.25% running at 8-10ml/h rate for the first 48 hours.

If the T10 dermatome was not crossed, in 16 out of 18 patients who received continuous TAP analgesia, the continuous infusion was provided for sole analgesia postoperatively. The technique has not gained popularity mainly because of its technical difficulty. Disadvantages also include the dermatomal limitation as well as its inability to cover visceral pain. The advantages are that the continuous TAP infusion does not cause hemodynamic imbalance, function and mobility in lower limbs are preserved and it is safe to use in sepsis or patients who have coagulation disorders. Furthermore, it is non-sedating and does not cause obstructions in bowel movement or impede respiratory function. (Niraj et al., 2015: 582) It is stated that epidural is still superior in providing postoperative analgesia but transversus abdominis plane can be a viable option if the use of epidural is contraindicated or it fails or the patient refuses (Niraj et al., 2015: 583).

Rectus sheath catheter like epidural and transversus abdominis plane, allows continuous infusion of numbing agent for analgesia without mobility restrictions. The placement of rectus sheath catheters happens whilst the abdominal wall is open and is secured to the skin using sutures or wound dressings (Naumann et al., 2022: 346).

Results showed that even with the rectus sheath catheter being efficient in providing postoperative analgesia, still n=140 (50,7%) required a PCA pump to endorse analgesia. One major finding from (Naumann et al., 2022: 347-349) was that patients with RSC seemed to have shorter stay in the intensive care unit as well as have fewer serious postoperative complications. It was found by several different studies that combining medications during the post operative period reduces patients' pain and usage of opioids and other strong pain medications (Aweke et al., 2018:9; Falk et al., 2021:67; Huepenbecker et al., 2019: 357).

Oxycodone and morphine are commonly used in Europe as opioid pain management. Sufentanil and fentanyl are more common in Asia. Studies have shown that the k-opioid receptor is involved when a patient is experiencing visceral pain thus patients that have PCA pumps might not be fully satisfied in pain management if they receive for example oxycodone over fentanyl. Fentanyl and sufentanil are more commonly used in Asia by anesthesiologists since their advantages include less post-operative nausea and vomiting as well as respiratory depression which are known adverse effects of opioid use. (Han et al., 2018: 2).

6.3 Advantages and disadvantages of nonpharmacological methods

By giving patients preoperative guidance for 15 minutes concerning deep breathing, coughing and foot exercises compared to the control group who received standard care it was found that the experimental group had lower pulse levels on the second postoperative day, normal wound healing as well as reduced pain medication use (Joseph and Devi, 2023: 14-16).

Extensive research has been done about lavender essential oil and how it reduces discomfort, muscle tension, insomnia as well as acute and chronic pain. Topically and orally given lavender oil is shown to be safe and supports pharmacological pain management but not to be effective on its own (Stallings Welden et al., 2021: 292-295).

7 Discussion

In all research that is being done ethical questions and validity should be assessed thoroughly to maintain integrity. The main aspects of research integrity are reliability, trustworthiness, and carrying responsibility for one's writing. (Tutkimuseettinen neuvottelukunta, 2023)

For research to be ethically appropriate and reliable, “the research must be conducted according to the responsible conduct of research.” Ethical reevaluation means that the research plan is evaluated strictly and follows the ethical guidelines. (Finnish national board on research integrity, 2023)

While this thesis is written it is ethical to remain honest, and open and respect other researchers' work and execute the thesis in a systematic order, following the guidelines set. Plagiarism is against ethical guidelines and should be avoided. (Arene, 2019, pp.8–9)

7.1 Validity and reliability

In qualitative research validity means the proper data, tools, and processes. To determine if the research question is valid for the proper outcome, the researcher needs to think about their choice of methodology. Also, data analysis, sampling, and based on the sample and context, the results and conclusions are valid. (Leung, 2015)

The research project needs to be completely transparent to be reliable. (Holloway and Galvin, 2023, pp.303–305) In qualitative research, reliability can also be measured by the trustworthiness of the procedure and generated data. Data can be “revisited” to confirm findings, and to overcome bias the research data can be sent to an independent researcher to view and confirm the results.

Qualitative content analysis is viewed as a reliable process. In content analysis, specific codes are created to describe the data and it can be revisited at times for stability. (Roberts and Priest, 2006) Quality assessment of the selected articles was conducted by the writer, utilizing different assessment criteria. The Finnish Centre for Evidence-Based Health Care has guidelines for assessing the quality of the articles which was utilized (Hoitotyöntutkimussäätiö, 2018). Julkaisufoorumi (JUFO) portal was used to check the quality of the journals in which the studies were published. JUFO assesses

the quality on a scale of 0-4. All the journals were between 1-3 in quality (Julka-
isufloorumi, 2023).

Only two of the nine chosen articles were nursing-related but since the topic of the the-
sis can be utilized by all healthcare professionals and is not specifically targeted to
nurses it was deemed as an irrelevant factor. Prisma flow diagram was used to report
the process of data search and selection.

7.2 Conclusions and utilization of the results

The aim was to study the advantages and disadvantages of different pain management
methods after laparotomy. Several different methods were studied which included
pharmacological and non-pharmacological methods.

Pharmacological methods have several advantages, they are most efficient and effec-
tive in treating post-operative pain. The most advantages have the patient-controlled
analgesia devices which are easy for the patient and healthcare professional to oper-
ate. Continuous infusion and bolus doses or both as well as several medications can
be given via PCA pump. The studies selected for this literature review showed no other
disadvantages or adverse effects concerning the use of PCA pump except that its use
might be contraindicated if the patient is unable to understand how to operate the de-
vice.

Epidural catheter as well as continuous transversus abdominis plane block are effec-
tive in postoperative pain management. The main advantage is the possibility of contin-
uous analgesic infusion which offers relief and enables mobility and postoperative re-
habilitation in general. By providing analgesia via epidural or TAP the use of opioids is
reduced. The main disadvantage is the adverse effects that epidural analgesia can
cause which is hypotension or the catheter going into spinal space, and with TAP the
catheters are technique-wise difficult to operate and do not provide durable analgesia
beyond the T10 dermatome.

Non-pharmacological methods can be used in combination with pharmacological meth-
ods but on their own, they are not sufficient in managing postoperative pain after lapa-
rotomy. A clear advantage of non-pharmacological methods is that they are safe to use
and have no disadvantages.

Limitations were identified and included the difficulty in finding reliable and respected research concerning the topic as well as it was difficult finding studies on nonpharmacological methods thus this thesis focuses more on the pharmacological methods in pain management of laparotomy operated patients.

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Table of selected articles

Authors, Year & Country	Topic/Purpose	Methodology/Methods	Participants	Main outcomes	Limitations
1. Joseph & Devi, 2023, Bangalore	Optimising post-operative recovery of elective abdominal surgery patients to identify and validate a multimodal approach	Quantitative, Quasi-experimental, post-test-only group design	N =60, 30 in each experimental and control group, patients	By giving patients preoperative guidance on breathing and mobilization exercises it was shown that it reduced their pulse, promoted healing and reduced the need for pain medication.	No limitations mentioned
2. Naumann et al. 2021, United Kingdom	Rectus sheath catheter analgesia versus standard care following major abdominal surgery	Quantitative, Observational study	N= 911 patients	Even with the rectus sheath catheter being efficient in providing postoperative analgesia, still n=140 (50,7%) required a PCA pump to endorse analgesia.	- selection bias - errors in data - comparison of non-randomized groups
3. Stallings et al. 2021, United states of America	Abdominal surgical patients randomized to aromatherapy for pain management	Quantitative, randomized controlled trial	N= 172 patients	Aromatherapy aided in the control of pain intensity for abdominal surgery patients	- missing data and confounders associated with it
4. Falk et al. 2021, United Kingdom	Comparison between epidural and intravenous analgesia effects on disease-free survival after colorectal cancer surgery	Quantitative, a randomized multicentre controlled trial	N= 221 patients	Patients in the epidural group had significantly better pain relief during the first 24 hours compared to patient-controlled analgesia group	- epidural analgesia was provided according to hospital standards and not specifically modified to a study.

					- change in surgical technique during the enrollment period.
5.Young et al. 2020, Australia	Intrathecal morphine in post-operative analgesia for colorectal cancer surgery	Quantitative, retrospective study, participants were identified through an acute pain service clinical data set.	N =283 patients	Intrathecal morphine and patient-controlled analgesia can achieve similar analgesic effects after laparotomy, resulting in a reduction of oral opioid consumption	- potential for confounding factors not documented in the database - relying on the accuracy of self-report
6.Huepenbecker et al. 2019, United states of America	Continuous epidural infusion in gynecologic oncology patients undergoing exploratory laparotomy: The new standard for decreased postoperative pain and opioid use	Quantitative, Retrospective cohort study	N= 561 patients	Perioperative epidurals used in patients undergoing laparotomy correlate with a decrease in postoperative opioid use, an increase in non-opioid medication, and improved pain relief.	- conducted at a single institution - epidurals were introduced at the same time as ERAS protocol -> it is not possible to say that the change in pain medication was due to epidural alone.
7.Han et al. 2018, China	Oxycodone versus sufentanil in adult patient-controlled intravenous analgesia after abdominal surgery	Quantitative, a prospective randomized double-blinded multiple-center clinical trial	N= 200 patients were screened and N= 175 were enrolled to participate in the study	Both methods provided adequate pain relief postoperatively, there were less drug consumption and adverse effects in the opioid-receiving group	- the study was done only in one province in China.
8.Aweke et al. 2018, Etiopia	Comparison of preemptive paracetamol, paracetamol-diclofenac & and paracetamol-tramadol combination on postoperative pain after elective abdominal surgery under general anesthesia	Quantitative, a randomized control trial study	N= 63 patients	The total tramadol consumption was significantly higher in the paracetamol group compared to the other two groups. Preemptive doses of paracetamol-tramadol and	- lack of control over confounding factors such as incision size and participation of different anesthetists and surgeons.

				paracetamol-diclofenac reduce the total tramadol consumption	- shorter duration of postoperative follow-up. - unavailability of adequate studies to compare the results.
9.Niraj et al. 2015, United Kingdom	Four quadrant transversus abdominis plane block and continuous TAP analgesia	Qualitative, Prospective single center audit over 3 years	N=124 patients	Both are effective techniques in providing post-operative pain management, but pain is not covered beyond the T10 dermatome.	No limitations mentioned

Data analysis

Subcategory	Generic category	Main category
<p>Advantages: Effective in pain management, easily accessible, comes in different forms (per os, intramuscular, intravenous, oral suspension)</p> <p>Disadvantages: Several contraindications and adverse effects, nausea and vomiting, constipation</p>	Opioids	Pharmacological methods
<p>Advantages:</p> <p>constant analgesic infusion, earlier recovery, improvement in pain management, less opioid use orally, and lower pain scores.</p>	Epidural	

Disadvantages:

hypotension, urinary catheter placement which can delay recovery

advantages: either single shot or continuous infusion, effective analgesia if the operated area does not go beyond the T10 dermatome, several different analgesic combinations can be used. Safe to use in sepsis and coagulation disorder patients. Does not cause hemodynamic imbalance, preserves movement in lower limbs. Non-sedating.

Disadvantages: does not provide durable analgesia beyond T10 dermatome, might require opioids or other supportive analgesia, in continuous TAP, catheter placement is technique vise difficult

Transversus abdominis plane

<p>advantages: less opioid use postoperatively</p> <p>Disadvantages: higher risk at postoperative pneumonia, might need relaparotomy to retrieve the catheters</p>	<p>Rectus sheath catheter</p>	
<p>advantages: several drugs can be given and combinations of different drugs, the possibility of constant infusion as well as bolus doses, patient can administer as needed, requires subcutaneous or intravenous cannula which is easy to remove and put in. Can also be used together safely with different methods.</p> <p>Disadvantages: if patient is unable to understand or comprehend how to use PCA pump</p>	<p>Patient controlled analgesia</p>	

<p>Advantages: Various medications, provides durable analgesic and supports other medications</p> <p>Disadvantages: there can be contraindications or patients background prohibits usage</p>	<p>NSAIDS</p>	
<p>Subcategory</p>	<p>Generic category</p>	<p>Main category</p>
<p>Advantages:</p> <p>Promotes healing in general, prevents the formation of blood clots, going home sooner, individuality and self-directedness.</p>	<p>Mobilization</p>	<p>Nonpharmacological methods</p>
<p>Advantages:</p>	<p>Aromatherapy</p>	

Safe as complimentary therapy reduces muscle tension, discomfort, acute pain and anxiety.

Disadvantages:

No significant improvement concerning pain management, not effective on its own.

Advantages:

Reduces aspiration risk and postoperative pneumonia

Breathing exercises

