

Abstract

The current opioid epidemic in the United States has taken countless innocent lives, one of the leading cause is over prescribing of opioids at discharge after common surgical procedures. There are mainly two types of surgical procedures: invasive (open) surgery or minimally invasive surgery. This study looked at the amount of opioids in Milligrams of Morphine Equivalents (MME) that was prescribed to 659 patients at discharge after either an invasive or minimally invasive surgical procedure. The results are expected to show that invasive surgeries lead to over prescribing of opioids as compared to minimally invasive surgery. This study concluded that patients are over prescribed opioids after invasive surgery and further investigation of which other minimally invasive surgery leads to over prescribing of opioids should be done in future studies.

Introduction

In 2017, the US Department of Health and Human Services (HHS) declared a public health emergency and revealed that the US has an Opioid Epidemic. Over the last two decades the number of drug overdose deaths has increased four times (1); in 2018 about 10.3 million people misused prescription opioids, and 47,600 people died from overdosing on opioids. One of the leading cause is prescription opioid misuse; these prescription opioids are usually administered during and after surgery to treat pain. Depending on the surgery, opioids may be administered multiple times throughout the procedure, and many times even after the surgery (5). This practice has led the United States (US) into an opioid epidemic which has led to the loss of numerous lives. Although, the number of deaths from opioids is increasing, opioids are still used for pain management during general surgeries and prescribed to patients at discharge too. Therefore, to aid in the process of solving the overall problem, this paper sought to identify is which type of surgery, invasive surgeries or minimally invasive surgeries, lead to more over-prescribing of opioid drugs at discharge. Invasive surgeries require opening different cavities of the body and repairing the affected organ, whereas minimally invasive surgery would create multiple small holes for a surgeon to look inside via video camera and repair using laparoscopic devices. We anticipate that patients that underwent minimally invasive surgeries would require less opioid prescriptions as incision sizes are small and less internal cuts would be made when compared to invasive surgeries.

First, the mechanism of action of opioids should be understood. These drugs act on three receptors primarily in the body: delta, kappa, and mu receptors (4). Of the three mu receptors of the midbrain is thought to be a major mechanism of opioid-induced analgesia. This receptor stimulating descending inhibitory pathways which leads to the activation of descending inhibitory neurons, which would prevent sensory of pain (4). Upon understanding the mechanism, opioids have become widely and commonly used due to their effectiveness; however now, ironically it may be causing more pain than relief. One in four patients receiving long-term opioid therapy struggles with opioid addiction (3). At first glance these opioids seem to help reduce pain felt by people; however, a large quantity will decrease the respiratory drive of the lungs followed by death shortly after. Therefore, this research study seeks to find out if opioids are being overprescribed in certain types of surgeries than others, so that we can minimize the risk of exposure to patients.

The broad two classification of surgical procedures are open surgery or invasive procedures, and minimally invasive surgery or laparoscopic procedure. An open surgery requires the cutting of skin, tissues, and/or muscle layers so that the surgeon has a full view of organs or structures that need to be operated on (6). Whereas, in an minimally invasive surgery, surgeons would make smaller incisions through which small fiber optic cameras and laparoscopic devices can enter to visualize and operate inside patients. Multiple studies have clearly shown that opioids are overprescribed routinely after common surgical procedures, but our research identifies the types of surgeries that are exposing patients to more opioids post-operatively. This study will persuade surgeons to utilize the surgical procedure in which less opioids are prescribed.

Prior work has demonstrated that minimally invasive surgery is associated with less pain postoperatively than open surgeries (2). This may be due to a smaller incision size and decrease in the division of muscle fibers and mobilization of the spermatic cord in a minimally invasive approach (2). There is an abundant amount of data comparing pain experience of patients and the opioid requirements of patients that do not distinguish between the two operative approaches. Current studies focus more on patient's personal pain experience instead of objective metrics of actual prescribed amount of opioids at discharge. Therefore, this study will quantify the amount of opioids in milligrams of morphine equivalents (MME) that was prescribed to patients at discharge that either had invasive or minimally invasive surgery; in order to also certify if indeed minimally invasive surgeries cause less pain and require less opioids be prescribed postoperatively. According to the U.S. Department of Health and Human Services (HHS) and the Center for Disease Control (CDC), the recommended maximum amount is 200 Milligrams of Morphine Equivalent (MME), and any amount over 200 MME is considered to be over prescription of opioids. Therefore, in this study too any amount over 200 MME was considered over prescription of opioids.

Lastly, this study also seeks to benefit society by both reducing patients negative long term outcome after surgeries as well as save on costs of complications of potential opioid overdose or addiction. The decreased use of opioids post operatively is key to managing the current opioid epidemic. In order to move forward in resolving the current situation, this study sought to find if there is more over-prescription of opioids after invasive surgery or after minimally invasive surgery.

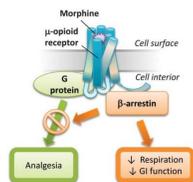


Figure 1. Opioid Receptor actions



Figure 2. Minimally Invasive Surgery

Methods and Materials

There were a total of 659 patients ranging from the age of 18-80 years old, who have gotten one of six surgical procedures. Of these six procedures, three procedures involve minimally invasive procedures and the other three are invasive procedures. These patients were prescribed opioids at discharge to control their pain levels post-operatively. Dividing patients based on their type of surgery and seeing which group is prescribed most opioids is the primary goal of this study. Therefore, having an average amount of prescribed opioids of three different surgeries utilizing the same procedural method in each group is sufficient to generalize for that group.

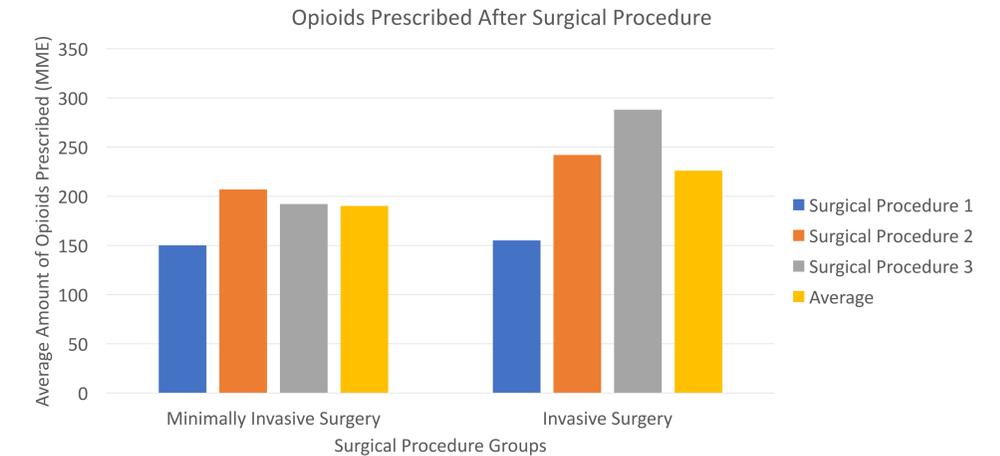
Patients were grouped based on their type of surgery, if the surgical procedure was minimally invasive or not. The following three minimally invasive procedures were included: inguinal hernia, cholecystectomy, and appendectomy. The following three open (invasive) procedures were included: inguinal hernia, mastectomy, and thyroidectomy. The amount of opioids that were prescribed to patients to control their post-operative pain was recorded utilizing pharmacy data records of each patient to ensure accuracy. Upon categorization of data, the average amount of opioids prescribed to them will be calculated for each group to determine which type of surgical procedure prescribes the most and over the recommended amount of opioids. According to the U.S. Department of Health and Human Services (HHS) and the Center for Disease Control (CDC), the recommended maximum amount is 200 Milligrams of Morphine Equivalent (MME), and any amount over 200 MME is considered to be over prescription of opioids. This method is best as it simplifies and improves accuracy of data collection, as well as lays out the parameters of what is considered over prescribing of opioids based on a reputable government agency.

Results

There was a greater overprescribing of opioids in the invasive surgical group compared to the minimally invasive surgical group. The average MME prescribed to patients with invasive surgical procedures was 226 MME, as compared to 190 MME in patients with minimally invasive surgeries. This indicates that most patients with minimally invasive surgeries are within recommended prescribing practices but patients with invasive procedures are on average over prescribed opioid by 13% (26 MME) of the recommended prescribing practices. Alternatively, patients undergoing minimally invasive surgery were given 5% (10 MME) less opioids than the recommended amount of 200 MME. Within the invasive procedure group, patients undergoing invasive thyroid surgery were prescribed the most opioids, 288 MME. Whereas the most opioids prescribed within the minimally invasive procedure group was laparoscopic cholecystectomy where 207 MME on average was prescribed.

Table 1. shows the average number of MME that was prescribed to patients at time of discharge in this study

Minimally Invasive Surgery			
Procedure	Number of Patients	Total Amount of MME prescribed	Average MME per patient
Inguinal Hernia	89	13,350	150
Cholecystectomy	208	43,056	207
Appendectomy	103	19,776	192
Total	400	76,182	190
Invasive Surgery			
Procedure	Number of Patients	Total Amount of MME prescribed	Average MME per patient
Inguinal Hernia	95	14,725	155
Mastectomy	76	18,415	242
Thyroidectomy	88	25,414	288
Total	259	58,554	226



Discussion

This particular study found that patient who underwent invasive surgical procedures have been over prescribed opioids compared to patients who underwent minimally invasive surgical procedures. The study also pointed out that patient who underwent invasive surgical procedures were given 13% (26 MME) more opioids than the recommended prescribing practices by HHS and CDC in the United States. Furthermore, the study proved that minimally invasive procedures did not lead to overprescribing of opioids as patients were prescribed 5% (10MME) less than the recommended amount. Although on average minimally invasive procedures tend to lead to prescribing of opioids within recommended guidelines, laparoscopic cholecystectomy actually had an average of 207 MME prescribed to patients. Therefore, for future research to improve and expand on this study, addition of more surgical procedures to both groups should be explored. Additionally, alternative studies should look at research into minimally invasive surgeries that prescribe opioids more than the recommended amount, so that prescribing practices can be changed to lower the amount of opioids given to patients to help reduce the current opioid epidemic. Other studies have also started to consider other alternatives to opioids such as the drug Ketamine; therefore, combing studies should also be a potential research study to help solve the current opioid epidemic.

Conclusions

It was hypothesized that invasive (open) surgery would lead to an over prescription of opioid compared to minimally invasive surgery. Other studies had focus more on patient's personal pain experience instead of objective metrics of actual prescribed amount of opioids at discharge. Therefore, this study has quantified the amount of opioids in milligrams of morphine equivalents (MME) that was prescribed to patients at discharge that either had invasive or minimally invasive surgery. Thus, the trends in this study have certified that indeed invasive surgeries would lead to an over prescription of opioids, whereas minimally invasive surgeries require less opioids be prescribed postoperatively. It would be recommended for future studies to add additional surgical procedures to both groups to expand the results to include mostly all surgical procedures. Also, specifically looking at which surgical procedure within just the minimally invasive surgical group leads to most prescribing of opioids, is recommended as well.

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