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Analysis of Two Treatment Modalities for Post-surgical Pain after Hemorrhoidectomy

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Abbreviations:
ACAT: around-the-clock" analgesic treatment;
ODAT: On-demand analgesic treatment;
BMI: Body mass index;
VAS: Visual Analogue Scale;
PPH: Procedure for Prolapse and Hemorrhoids;
HAL RAR: Hemorrhoidal Artery Ligation and Recto Anal Repair.

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Rezumat

Analiza a două modalități de tratament utilizate pentru durerea post hemoroidectomie

Introducere: Acest studiu a avut ca scop compararea eficacității a două tratamente farmacologice utilizate pentru gestionarea durerii postoperatorii după hemoroidectomie: tratamentul analgezic continuu (TAC) şi tratamentul analgezic "la nevoie" (TAN).
Material şi Metode: Studiul, desfăşurat în perioada iulie 2016 - decembrie 2020, a inclus 5335 de pacienți la care s-a practicat hemoroidectomie. Participanții au fost împărțiți în două grupuri: TAC (3767 pacienți) şi TAN (1568 pacienți). Studiul a fost înregistrat la clinicaltrials.gov (NCT04953182).
Rezultate: Vârsta medie a pacienților a fost de 47,47 ani şi a inclus 59,98% bărbați. Postoperator, 14,13% au raportat durere severă, 36,49% durere moderată, 34,28% durere uşoară şi 15,09% fără durere. Durerea maximă, măsurată pe scala analog vizuală (VAS), a fost de 3,04 pentru grupul TAC şi 4,95 pentru grupul TAN ($p<0.001$). Durerea medie a fost de 0,79 (TAC) şi 1,45 (TAN) ($p<0.001$). Durerea la externare a fost de 0,42 pentru TAC şi 0,63 pentru TAN ($p<0.001$). Grupul TAC a raportat constant niveluri mai scăzute de durere în toate momentele măsurate. Factorii de risc semnificativi pentru durere severă au fost o valoare mare a IMC şi vârsta mai tânără ($p=0.049$ şi $p<0.001$, respectiv). Administrarea TAC a dus la o reducere semnificativă a utilizării opioidelor: meperidina cu 68,38%, morfina cu 43,57%, tramadolul cu 46,82%, oxicodona cu 38,74% şi codeina cu 53,40%. Utilizarea analgezicelor non-opioide a fost, de asemenea, semnificativ mai redusă în grupul TAC cu 16% până la 59% comparativ cu grupul TAN.

Concluzie: Hemoroidectomia induce, de obicei, dureri postoperatorii moderate, doar 14% dintre pacienți raportând dureri severe. Un regim de gestionare a durerii multimodal, pe un program fix, indiferent de tipul procedurii şi anesteziei, reduce durerea de la moderată la uşoară post-hemoroidectomie. Această abordare reduce, de asemenea, necesitatea analgezicelor opioide şi non-opioide. Un IMC mai mare şi o vârstă mai tânără sunt factori de risc pentru durerea postoperatorie severă.

Cuvinte cheie: durere postoperatorie, managementul durerii, hemoroidectomie, analgezice, opioide, non-opioide

Abstract

Background: This non-randomized study aimed to compare the efficacy of two pharmacological treatments, "around-the-clock" analgesic treatment (ACAT) and "on-demand" analgesic treatment (ODAT), for managing postoperative pain following hemorrhoidectomy.

Material and Methods: The study, conducted from July 2016 to December 2020, included 5335 hemorrhoidectomy patients. Participants were divided into ACAT (3767) and ODAT (1568) groups. The study was registered at clinicaltrials.gov (NCT04953182).

Results: Patients had a mean age of 47.47 years, with 59.98% males. Postoperatively, 14.13% reported severe pain, 36.49% moderate, 34.28% mild, and 15.09% no pain. ACAT group's maximum pain was 3.04 (VAS), ODAT 4.95 (p; average pain was 0.79 (ACAT) and 1.45 (ODAT). Discharge pain was 0.42 (ACAT) and 0.63 (ODAT) VAS. The ACAT group consistently reported lower levels of pain across all measured instances. Higher BMI and younger age were pain risk factors (p=.049, p<.001 respectively). ACAT administration resulted in reduced opioid usage, with meperidine showing a 68.38% decrease, morphine 43.57% less, tramadol 46.82% less, oxycodone reduced by 38.74%, and codeine by 53.40%. Additionally, the use of non-opioid analgesics was notably lower in the ACAT group, ranging from 16% to 59% less compared to the ODAT group.

Conclusion: Hemorrhoidectomy induces moderate postoperative pain, with only 14% experiencing severe pain. A fixed schedule multimodal pain regimen, regardless of procedure and anesthesia type, reduces pain from moderate to mild post-hemorrhoidectomy. This approach also decreases opioid and non-opioid analgesic requirements. Higher BMI and younger age are identified as risk factors for elevated postoperative pain.

Key words: postoperative pain, pain management, hemorrhoidectomy, analgesics, opioids, non-opioids

Introduction

The ultimate goal of this research is to contribute evidence-based recommendations for optimizing postoperative pain management strategies in the context of hemorrhoidectomy, aiming to improve patient comfort, reduce opioid usage, and enhance overall recovery outcomes.

Hemorrhoidal disease (HD) represents a common affliction of the anal canal, manifesting through prevalent symptoms such as bleeding, pain, pruritis, and mucosal prolapse (1,2). However, the absence of a precise definition for "hemorrhoid" complicates efforts to accurately estimate its prevalence, as asymptomatic individuals are less inclined to seek medical consultation (3).

Approximately 38% of the population receives a diagnosis of hemorrhoids, yet only 4.4% necessitate active intervention (4). Furthermore, a considerable 40% of those with hemorrhoids remain asymptomatic, with treatment reserved for those encountering symptomatic manifestations (5). Initial preference is given to conservative therapies, with operative measures required for a mere 9.3% of symptomatic cases, while 45.2% of symptomatic individuals undergo conservative therapy (6).

The management of hemorrhoids has rapidly evolved, introducing diverse treatments to alleviate postoperative pain, hasten the return to normalcy, diminish complications, and decrease recurrence rates (7). Surgical interventions become imperative in advanced stages (III and IV) of the disease for symptomatic patients, often involving postoperative pain management with opioids for 20 to 40% of cases (8,9).

Effective postoperative pain management is not only imperative for humanitarian reasons but also essential in mitigating surgery-induced responses. Despite advancements in pain medicine, inadequate postoperative pain control persists as a significant issue, impacting patient outcomes and satisfaction (10,11).

However, despite advances in pain medicine, postoperative pain control remains problematic and constitutes an important unresolved issue that leads to increased expenses and patient dissatisfaction (12).

The concept of multimodal "opioid-sparing" analgesic techniques, introduced in 1993, seeks to enhance analgesia by synergistically combining medications (13,14). Recent developments underscore the critical need for improved analgesia to expedite recovery and reduce hospital re-admissions, morbidity, and post-discharge convalescence (15). Recognized factors contributing to early postoperative pain encompass younger age, male gender, advanced education, constipation, external component, anxious state, trait, and high anal resting tone (16).

Inadequate postoperative pain treatment remains an enduring issue, leading to adverse outcomes, including chronic postsurgical pain (17). Despite this, a dearth of literature exists comparing "around-the-clock" analgesic protocol (ACAT) and "on-demand" analgesic aproach (ODAT) for hemorrhoids.

This study endeavors to assess the impact of two multimodal analgesia protocols: a fixed schedule (ACAT group) compared to an on-demand (ODAT group) approach. Primary objectives encompass evaluating pain levels at various postoperative stages using the Visual Analogue Scale (VAS), analyzing the type and quantity of analgesic drugs administered in each treatment group, and understanding the potential benefits of ACAT in reducing both opioid and non-opioid analgesic usage compared to ODAT.

Moreover, the research seeks to identify potential risk factors for heightened postoperative pain, such as age and BMI, offering valuable insights into patient characteristics influencing pain outcomes. The ultimate objective is to contribute evidence-based recommendations for optimizing postoperative pain management in hemorrhoidectomy, with the aim of improving patient comfort, minimizing opioid usage, and enhancing overall recovery outcomes.

Material and Methods

The current investigation is a prospective non-randomized study designed to assess the efficacy of two distinct analgesic modalities in patients undergoing elective hemorrhoidectomy. The study was conducted at a private Medical Center in Israel, spanning from July 1, 2016, to December 31, 2020. Participants consisted of individuals undergoing elective hemorrhoidectomy for 3rd and 4th degrees of hemorrhoidal disease.

Patients were categorized into two groups based on their chosen pain modality treatment: the ACAT and the ODAT groups. Ethical approval for the clinical trial research proposals (0014-17-ASMC) was obtained from the Assuta Medical Center Institutional Helsinki Committee. Given the minimal

procedural involvement and the absence of added risk due to the established institutional pain treatment protocol, the requirement for patient consent was waived. The study was registered on clinicaltrials.gov (NCT04953182) on July 7, 2021.

In the ACAT group, a fixed-interval protocol was employed for administering painkillers, as prescribed by the surgeon or anesthesiologist. The treatment regimen involved a combination of two non-opiate analgesics or one non-opiate combined with a low-dose weak narcotic, administered on a predetermined schedule. Additional analgesics were provided as needed, based on patient requirements.

In the ODAT group, painkillers were administered by nurses in response to patient-reported pain levels, guided by protocols utilizing the VAS. Physicians prescribed analgesics based on their experience without enforcing a specific treatment modality.

The study encompassed all surgical approaches and anesthesia types, including their combinations, and analyzed each comprehensively. Physicians issued orders for both groups based on a list of potential non-opiate and opioid analgesic drugs. All patients included in the study underwent an inpatient stay, with ambulatory patients excluded. Discharge occurred when pain was effectively managed without the necessity for high dosages of narcotic's medications to be continued at home, all the patients received, at discharge, a prescription indicating the pain management for home convalescence.

Statistical Analysis

Data analysis involved the extraction of patient information from medical records and Pain Services Department records at Assuta Medical Center, facilitated by the MDClone platform (MDClone Ltd, Beer Sheva, Israel). Baseline patient characteristics were summarized using means and percentages, and a two-sample test was employed to compare these characteristics between the study groups.

Pain assessments were conducted every 5 minutes in the recovery room and every two hours in the surgery wardroom. Key pain metrics, including maximum pain, mean pain during hospitalization, and pain upon discharge, were analyzed. The quantity and type of analgesics administered, as well as complications in both groups, were recorded. The ANOVA test was applied to assess variations in pain scores attributed to different surgeons.

Numeric pain measures, obtained through the Visual Analogue Scale (VAS) (18), ranged from 0 (no pain) to 10 (worst possible pain). A t-test was employed to compare VAS values between groups. The comparison of medication usage, quantified in milligrams per patient and expressed as a percentage, was conducted using the chi-square test.

Statistical analysis was carried out using the SPSS statistical package, Version 21 (SPSS Inc, Chicago, IL, USA). The predetermined significance level was set at $p < 0.05$.

This robust statistical methodology ensures a comprehensive evaluation of the efficacy of the analgesic strategies, comparing both pain outcomes and medication requirements, while considering potential variations associated with different surgeons.

Results

Population

A total of 5,335 patients who underwent elective hemorrhoidectomy were enrolled in the study, comprising 3,767 participants in the ACAT group and 1,568 in the ODAT group. Demographic characteristics between both groups were comparable, except for the length of stay, which was notably longer in the ODAT group (refer to *Table I*). The hemorrhoidectomies were conducted by 114 seasoned senior surgeons, each contributing varying numbers of procedures.

Analysis of the types of anesthesia used revealed significant differences between the groups, particularly in patients who received regional anesthesia, demonstrating an extended analgesic effect. This divergence could poten-

Table 1. Demographic characteristics of the study groups

Characteristic	ACAT group N=3767		ODAT group N=1568		p-value
	Mean	SD/percent	Mean	SD/percent	
Age (yrs.)	47.48	13.363	47.46	13.358	.960
Gender					
Male	2,277	60.45%	923	58.86%	.280
Female	1,490	39.55%	645	41.14%	.280
BMI (kg/m^2)	25.78	4.143	25.90	4.246	.339
Length of stay (Hs)	17.71	8.772	19.21	9.512	<.001*
Anesthesia type					
General	3,443	91.40%	1266	80.74%	< .001*
Regional	174	4.62%	169	10.78%	
Sedation	85	2.26%	89	5.68%	
Local	65	1.73%	44	2.81%	
Procedure					
Radical	2,531	67.19%	1113	70.98%	.251
HAL (RAR)	246	6.53%	76	4.85%	.031*
LigaSure H.	907	24.08%	350	22.32%	.293
PPH	83	2.20%	29	1.85%	.484

*- Statistical significance

Abbreviations: ACAT – Around-the-clock analgesic treatment, ODAT – On-demand analgesic treatment, SD - Standard deviation, BMI - Body mass index, yrs. - years, Kg - kilograms, m - meters, Hs - hours, HAL - Hemorrhoidal artery ligation, RAR - Recto-anal repair, PPH - Procedure for prolapse and hemorrhoids, H. - Hemorrhoidectomy

tially impact their pain levels during the initial postoperative hours.

Various surgical techniques were employed, including Radical Hemorrhoidectomy (Ferguson or Milligan-Morgan), LigaSure Hemorrhoidectomy, Doppler-guided hemorrhoidal artery ligation (HAL), Hemorrhoidal Artery Ligation and Recto Anal Repair (HAL-RAR), and the procedure for prolapse and hemorrhoids (PPH). Notably, there were disparities in the percentage of HAL-RAR procedures, with the ODAT group accounting for 4.85% compared to the ACAT group's 6.85% (p= .031).

Pain Evaluation

The mean number of pain measurements during hospitalization was 13.91 times (SD ± 5.859). Following surgery, a significant proportion of patients experienced postoperative pain, with 14.13% reporting severe pain and 66.71% of these undergoing excisional hemorrhoidectomy. Moderate pain was reported by 36.49% of patients, while 34.28% reported mild pain, and 15.09% reported being pain-free. Upon discharge, 64% of patients reported no pain, and 34.69% reported mild pain.

In all three pain measurement categories, including maximum pain, mean pain during hospitalization, and pain upon hospital discharge, the ACAT group consistently reported significantly less pain than the ODAT group (p<.001), as visually depicted in *Fig. 1.* Specifically, the mean maximum Visual Analogue Scale (VAS)-measured pain for the ACAT group was 3.04 (SD ± 2.396), contrasting with 4.95 (SD±2.176) for the ODAT group (p<.001). The average pain level in the ACAT group was 0.79 (SD±0.829), in contrast to 1.45 (SD±0.862) in the ODAT group (p<.001). Furthermore, the pain reported at the time of discharge was 0.42 (SD±0.730) for the ACAT group and 0.63 (SD±0.799) for the ODAT group (p<.001).

The study extended its comparison to assess pain levels across various procedures. Patients undergoing LigaSure hemorrhoidectomy reported notably lower maximum pain levels compared to those undergoing alternative procedures (p<.001). Average pain levels across the four procedure types were found to be similar, showing no statistically significant differences (p=.316). Upon discharge, patients who underwent HAL-RAR and PPH procedures reported significantly lower pain levels

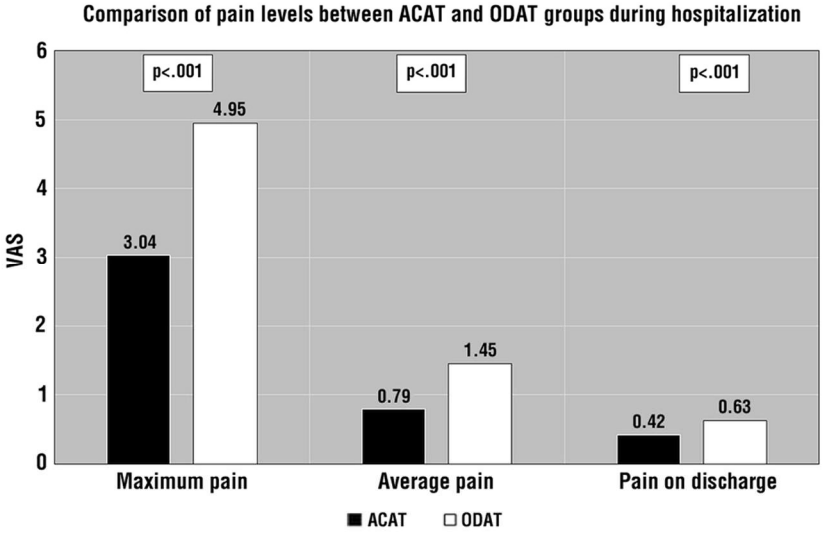

Figure 1. Comparing pain reported in each group, the ACAT group patients reported less pain at all three points in the time under study, with statistically significant differences with the reports of patients in the ODAT group, with the maximum mean pain in both groups being moderated and milder at discharge.

compared to those undergoing Radical and LigaSure hemorrhoidectomy (p<.001), as illustrated in *Fig. 2*.

The analysis of variance (ANOVA) revealed notable distinctions in pain scores, both between different surgeons (p<.001) and among identical procedures within each surgeon (p<.001), as detailed in *Table 2*.

When comparing the ACAT and ODAT groups based on the procedure, the ACAT group demonstrated superior pain relief across various procedures, including Radical Hemorrhoidectomy, LigaSure hemorrhoidectomy, HAL-RAR, and PPH (p<.001, p<.001, p=.026, and p=.004, respectively), as outlined in *Table 3*.

Table 2. ANOVA table comparing pain per surgeon (More than 10 surgeries performed).

Analysis of variance table

Source	df	SS	MS	F-value	p-value
Factor	78	675.64	8.66	14.095	<.001
Error	5038	3096.17	0.61		
Total	785038	3771.81			

Depending on the type of anesthesia, the ACAT group reported lower pain levels with

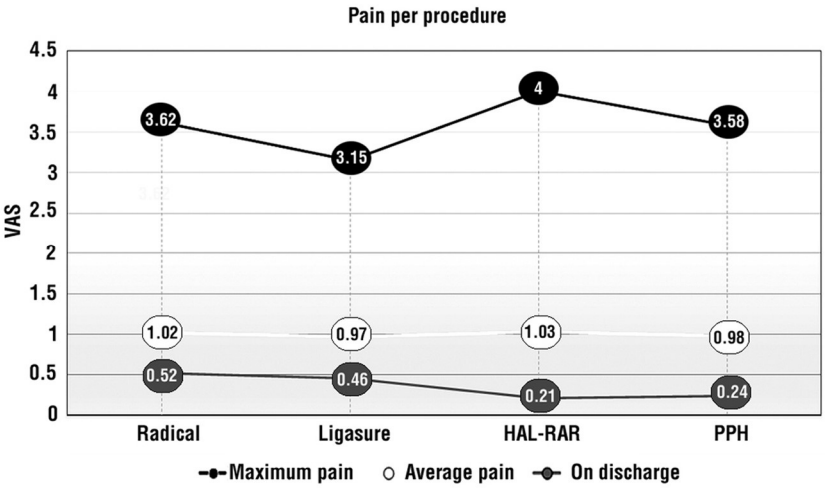

Figure 2. Analyzing the pain reported by procedure, the maximum pain reported by patients who underwent the HAL-RAR procedure significantly was lower than other procedures, the average pain reported was similar for all procedures, and at the time of discharge, there were fewer reports of pain from patients who underwent HAL-RAR and PPH.

Table 3. Pain per procedure type in the ACAT and ODAT groups

Procedure	ACAT group			ODAT group			p-value
	Patients	Mean pain	SD	Patients	Mean pain	SD	
Radical H.	2,531	0.83	0.780	1,113	1.47	0.843	<.001*
LigaSure H.	907	0.78	0.790	350	1.46	0.898	<.001*
HAL (RAR)	246	0.9	0.898	76	1.22	0.924	.026*
PPH	83	0.91	0.898	29	1.35	0.924	.004*

The pain per type of operation did not present significant differences in postoperative pain. When the pain of the patients was analyzed by the study group, there were significant differences showing that around-the-clock pain control is the best treatment modality for relief from postoperative pain.

*- Statistical significance.

Abbreviations: SD - standard deviation, H. - Hemorrhoidectomy, HAL- Hemorrhoidal artery ligation, RAR - Recto-anal repair, PPH - Procedure for prolapse and hemorrhoids.

general anesthesia, local anesthesia, and sedation alone (p<.001). However, in the case of regional anesthesia, the results did not reveal statistically significant differences (p=.681). Specifically, the combination of peri-anal injection of Bupivacaine 0.5% and general anesthesia resulted in prolonged analgesia and lower pain reports (*Table 4*).

Regardless of the pain relief regimen, the study analyzed the impact of patient factors such as BMI and age on pain scores. The study results showed that individuals with a higher Body Mass Index (BMI) reported more pain (p=.049), indicating that as BMI increased, the likelihood of experiencing pain also increased. Additionally, the investigation demonstrated a noteworthy inverse relationship between age and postoperative pain, with higher age associated with a decrease in reported pain (p<.001). These insights are further elaborated in *Table 5*.

Impact of Analgesic Strategies

To simplify the comparison of analgesic drug usage, the study utilized the amount of each drug expressed in milligrams per person. Opiates such as morphine, meperidine, tramadol, oxycodone, and codeine were notably reduced in the ACAT group compared to the ODAT group (p<.001), also oxycodone (p= .004). Fentanyl was excluded from the analysis due to its usage in close proximity to the surgery, and no significant differences were demonstrated between the two groups.

Non-opioid analgesics including dipyrone,

Table 4. Pain by anesthesia type and per group

Pain by anesthesia type							
Type of anesthesia		**Number**		**Mean pain**		**SD**	**p-value**
General		4709		1.01		0.879	.423
Regional		343		0.97		0.676	
Sedation		174		1.09		0.707	
Local		109		1.07		0.839	
Pain in ACAT and ODAT group by anesthesia type							
Type of anesthesia	**ACAT**			**ODAT**			**p-value**
	Number	**Mean pain**	**SD**	**Number**	**Mean pain**	**SD**	
General	3,443	0.81	0.797	1,266	1.54	0.875	<.001*
Regional	174	0.95	0.712	169	0.98	0.637	.681
Sedation	85	0.89	0.635	89	1.27	0.713	<.001*
Local	65	0.93	0.817	44	1.27	0.831	<.001*

There were no differences when we analyzed patients' reports of pain by type of anesthesia, but when we compared pain reported per group, there was a statistically significant difference in favor of the ACAT group, except when regional anesthesia was used.

*- Statistical significance.

Abbreviations: SD - Standard deviation

Table 5. Pain after hemorrhoidectomy by BMI and AGE

BMI	Number	Mean	SD	p-value
Under 20 Kg/m²	273	0.939	0.861	<.049*
20.01-25 Kg/m²	2,218	0.982	0.859	
25.01-30 Kg/m²	2,052	1.023	0.854	
30.01-35 Kg/m²	642	1.058	0.863	
35.01-40 Kg/m²	114	1.137	0.941	
Above 40.01 Kg/m²	36	1.212	0.962	
AGE				
18-30 y.o.	516	1.062	0.885	<.001*
30.01-50 y.o.	2,649	1.075	0.888	
50.01-70 y.o.	1871	0.946	0.824	
Above 70.01 y.o.	293	0.730	0.704	

Risk factors for increased pain after hemorrhoids surgery are higher BMI and younger age. None of the other variants analyzed were identified as risk factors.

*- Statistical significance.

Abbreviations: BMI - Body mass index, SD - standard deviation, Kg - Kilogram, m² - meter squared, y.o.- Years old.

diclofenac, Toradol, acetaminophen, and ibuprofen were used considerably less in the ACAT group compared to the ODAT group. In the ACAT group, the morphine requirement was 21.94 mg, significantly lower than the ODAT group, where it was 116.87 mg (p<.001) *(Table 6)*. This trend was consistent for meperidine, oxycodone, tramadol, and codeine. The only exception was fentanyl, administered exclusively within the first thirty minutes after surgery.

Specifically, in terms of opioids, the ACAT group demonstrated a remarkable reduction in meperidine use by 68.38% compared to the ODAT group. Similarly, morphine use decreased by 43.57%, oxycodone by 38.74%, tramadol by 46.82%, and codeine by 53.40%.

Among non-opioid drugs, the ACAT group exhibited a reduction of 32.24% in dipyrone use compared to the ODAT group. Diclofenac use was notably reduced by 58.60%, acetaminophen by 59.02%, and ibuprofen by 16.32%. In all instances, the usage of these drugs was significantly lower in the ACAT group compared to the ODAT group (p<.001), as shown in *Fig. 3*.

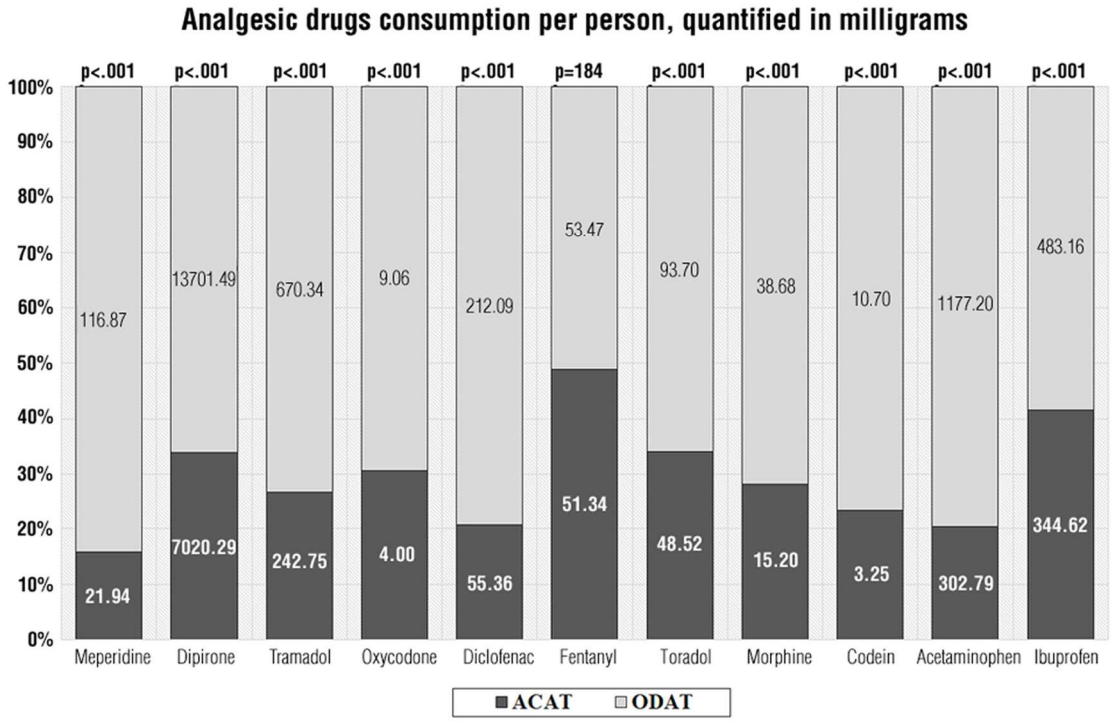

Figure 3. The quantity of analgesics needed – opiates and non-opiate – was less in the ACAT group as compared to the ODAT group. Fentanyl was excluded due to its use during the operative time alone and not in the postoperative period

Table 6. Use of analgesic drugs

Drug	ACAT		ODAT		p-value
	Total in MGS.	MGS. per patient	Total in MGS.	MGS. per patient	
Opioids					
Morphine	57246.6	15.20	60652	38.68	<.001*
Meperidine	82640	21.94	183255	116.87	<.001*
Tramadol	914430	242.75	1051093	670.34	<.001*
Oxycodone	15067.5	4	14202.5	9.06	.004*
Codeine	12230	3.25	16780	10.70	<.001*
Tramadol	182780	48.52	146915	93.70	<.001*
Non-opioids					
Dipyrone	26445420.07	7020.29	21483943.67	13701.49	<.001*
Diclofenac	208550	55.36	332550	212.09	<.001*
Acetaminophen	1140600	302.79	1845850	1177.20	<.001*
Ibuprofen	1298200	3444.62	757600	483.16	<.001*
Toradol	182780	48.52	146914	93.70	<.001*

For all administered drugs, there was statistically significantly lower use in the ACAT Group as compared to the ODAT group, except for Fentanyl, whose administration is limited to the first thirty minutes after surgery.

*- Statistical significance

Abbreviations: Mgs. - milligrams

Complications

There were no significant differences in complications, readmissions, and revisions between the ACAT group and the ODAT group. Specifically, the complication rates were 3% (113 cases) for the ACAT group and 2.98% (39 cases) for the ODAT group, which is not a statistically significant difference (p=.822), (*Table 7*). Out of the 72 re-admissions, the most common reason was bleeding, in 40 patients (57.57%), followed by intractable pain (37.5%), local infection (4.16%), and late urinary retention (2.77%). Nevertheless, no significant differences were identified between the ACAT and ODAT groups regarding the reasons for re-admission. Among the 15 instances requiring re-operation, the majority (80%) involved cases of bleeding, while the remaining three cases (20%) were attributed to infection. It's worth noting that bleeding was also the most common reason for re-admission, and it appears to be a significant issue following these procedures. Overall, this information

Table 7. Complications in hemorrhoidectomy.

Complications	ACAT N: 3,767		ODAT N: 1,568		p-value
	N	Percent	N	Percent	
Bleeding	15	0.40%	6	0.38%	.915
Severe pain	22	0.58%	8	0.51%	.755
Infection	2	0.05%	3	0.19%	.123
Urinary retention	10	0.27%	1	0.06%	.126
Fall, Head Trauma	0	0.00%	1	0.06%	.133
Abdominal pain	1	0.03%	0	0.00%	.493
UTI	1	0.03%	0	0.00%	.493
Fecal impaction	1	0.03%	0	0.00%	.493
Re-admission	53	1.40%	19	1.21%	.583
Revision	12	0.32%	3	0.19%	.415
Total	113	3.00%	39	2.48%	.298

No statistically significant differences in complications were found between the study groups.

Abbreviation: ACAT – Around-the-clock analgesic treatment, ODAT – On-demand analgesic treatment, N - Number, UTI - Urinary tract infection

suggests that bleeding is a major concern following these procedures and may require re-operation or re-admission. Intractable pain is also a relatively common reason for re-admission, although it is less common than bleeding.

No adverse events occurred during the administration of analgesic drugs in either group.

There were no deaths reported as a result of the procedures in either the ACAT or ODAT group.

Discussion

Acute postoperative pain is a prevalent experience for patients undergoing hemorrhoid surgery. Despite surgical advancements, less than half of patients report adequate postoperative pain relief, indicating persistent challenges in pain management post-procedure (16). Early postoperative pain incidence following hemorrhoid surgery, as reported by Selvaggi, is substantial at 18.3%, with 40.4% experiencing prolonged pain, impacting recovery and quality of life (19). Lohsiriwat, found that a high percentage of hospitalized patients (73%) experienced moderate to severe pain following hemorrhoid surgery (20). This highlights the importance of appropriate and effective pain management in this patient population.

Despite advancements in surgical techniques and treatments, postoperative pain and discomfort remain significant challenges in the treatment of hemorrhoids (21,22). Our study suggests that the mean maximum reported pain peak in our patient cohort was moderate (VAS 5), while average pain was mild (VAS 3.4), indicating effective pain control during the hospital stay. Nevertheless, 14% reported severe pain at some point during their hospitalization. Notably, patients undergoing hemorrhoid resection with Ligasure exhibited lower maximum pain levels, aligning with Nienhuijs' findings (23). However, individual health status, hemorrhoid severity, and patient preferences should guide surgical technique selection.

While Burch et al. concluded that PPH resulted in less pain than conventional surgery (24), our study did not entirely corroborate this finding, except for a notable reduction in pain reported by PPH patients at the time of discharge. This divergence could imply that immediate postoperative pain relief is more pronounced with PPH; however, differences may diminish over time, highlighting the need for further research. Comparative studies between conventional surgery and HAL-RAR highlight the advantages of HAL-RAR in terms of pain reduction and a shorter recovery period (25). Discrepancies in pain levels reported by Rubbini may arise from variations in assessment methods, surgical techniques, and postoperative care (26).

Conventional hemorrhoidectomy remains the gold standard, providing long-lasting relief (27). Nevertheless, newer techniques like PPH, HAL-RAR, and Ligasure aim to minimize postoperative pain, expedite recovery, and reduce complications (28). The debate over the ideal surgical method persists, as no single approach currently stands out (28).

Our study demonstrates a consistent average pain level across different approaches, showing no significant fluctuation.

The choice of anesthesia type remains a subject of debate, and a 2020 review suggests potential advantages of local anesthesia over spinal anesthesia, including lower postoperative pain incidence, reduced need for rescue analgesia, and fewer complications (29). However, contrary to findings by Gorfine (30), our study did not identify clear advantages for any specific anesthesia type. The selection should be individualized, taking into account patient history and provider expertise (31). While prior studies have reported differences in pain based on anesthesia type (32,33), our study did not replicate these findings, emphasizing the importance of individualized decision-making. On the contrary, the present study corroborates that a combination of regional anesthesia and general anesthesia, along with local infiltration, ensures prolonged pain relief.

Multimodal pain management is increas-

ingly accepted, involving multiple medications or therapies targeting different pain pathways. Despite controversies over the best modality, evidence supports multimodal management's effectiveness post-hemorrhoid surgery (34). Moreover, non-pharmacologic methods, frequently underutilized, have the potential to augment pain control (35).

Our study indicates that higher BMI correlates with greater postoperative pain, aligning with van Helmond (36). Similarly, younger patients reported more pain, consistent with Hartwig's findings (37). Multimodal pain management, emphasizing non-opioid options, is crucial for reducing opioid-associated risks and dependency (38).

Effective pain relief with minimized analgesic doses is essential for improved outcomes and patient satisfaction. Multimodal analgesia aligns with this goal, as observed in our study, supporting fixed-schedule analgesia's efficacy in decreasing opioid and non-opioid use. This approach enhances safety and effectiveness, further contributing to ongoing efforts to reduce opioid dependence in the context of post-hemorrhoidectomy pain management (39).

Despite the study's strengths, including a substantial sample size, limitations like the lack of long-term follow-up and the multifactorial nature of pain perception should be acknowledged. Future research can build on these findings, addressing these limitations and refining pain management strategies following hemorrhoidectomy. In conclusion, optimizing postoperative pain management is crucial for enhancing patient outcomes and quality of life across various surgical techniques for hemorrhoids.

The study underscores the importance of individualized surgical technique selection, taking into account patient preferences, health status, and hemorrhoid severity. While conventional hemorrhoidectomy remains the gold standard (27), newer techniques such as PPH, HAL-RAR, and Ligasure show promise in minimizing postoperative pain and expediting recovery (40).

Anesthesia type selection should be guided by individual patient factors, as our study did not find clear advantages for one type over another. Multimodal pain management, emphasizing non-opioid options, emerges as a crucial aspect of effective postoperative care, providing relief while minimizing adverse effects associated with opioid use.

Our study, which compared the effectiveness of a fixed schedule of analgesic administration with an on-demand regimen, demonstrates that scheduled analgesia leads to a significant reduction in narcotic use by 38-68% compared to an on-demand regimen. Additionally, the use of non-opioid drugs decreased. These findings support the conclusion that the protocol employed in the ACAT group is not only more effective but also safer.

Our findings highlight the impact of patient factors, such as BMI and age, on postoperative pain, reinforcing the importance of tailored pain management approaches. The study supports the growing body of evidence that multimodal analgesia, particularly with a fixed schedule administration, can enhance pain control and patient satisfaction.

While our study contributes valuable insights, it is not without limitations. Long-term follow-up and a multifactorial understanding of pain perception are essential for a comprehensive evaluation. Nevertheless, the study's robust sample size strengthens its contributions, providing a foundation for future research to address these limitations and further refine postoperative pain management strategies after hemorrhoidectomy. In conclusion, optimizing postoperative pain management in hemorrhoidectomy is essential for improving patient outcomes and enhancing overall quality of life.

Conclusion

Hemorrhoidectomy induces moderate postoperative pain, with only 14% of patients experiencing severe pain. A fixed schedule multimodal pain regimen reduces pain from moderate to mild after hemorrhoidectomy, irrespective of the procedure and anesthesia type. This results in a significant reduction in

the required doses of opioids, ranging from 38% to 68%, along with a decrease in the dosage of non-opioids. Higher BMI and younger age were identified as risk factors associated with elevated postoperative pain.

Author's Contributions

SS: designed the work, analyzed the data, drafted the article, perform de figures and tables, and do the final article. IA: designed the work, and acquired and analyzed the data. IB: acquired the data. ES: Revised de article.

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Competing Interests

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript.

Conflicts of Interest and Source of Funding

All the authors declare no funding received and no conflict of interest.

Ethics Approval and Consent to Participate

The Assuta Medical Center Institutional Helsinki Committee reviewed and approved the clinical trial research proposals (0014-17-ASMC) and waived the requirement of patient consent due to the research not involving procedures and not adding risk by the protocol implemented as an Institutional mode of pain treatment.

The authors confirm that all the procedures were followed in accordance with the relevant guidelines of the Helsinki declaration.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Trial Registration

The study was registered at clinicaltrials.gov (NCT04953182) in July 7, 2021.
Available at: https://clinicaltrials.gov/ct2/show/NCT04953182

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