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Dexamethasone in Multimodal Pain Management for Laparoscopic Surgery: A Prospective Analysis

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Abstract. *Objective: The study aimed to assess the adjuvant role of dexamethasone in multimodal analgesia to control postoperative pain for various laparoscopic surgical procedures. Methods: From January to April 2023, a study was conducted at Baghdad Teaching Hospital involving 80 patients prepared for various laparoscopic procedures, classified as ASA grades I and II. The participants were divided into groups (A and B) of 40 patients. There were no significant differences between the groups regarding gender distribution, age, BMI, ASA grade, anesthesia duration, and surgical procedure duration. Group A comprises patients administered dexamethasone 8 mg intravenously one hour before the induction of anesthesia, whereas Group B patients received a normal saline (placebo). The analgesic effect was assessed by measuring the VAS score for each group at 1, 3, 6, and 24 hours post-discharge from the recovery room. The study also evaluated the necessity for potent analgesics among the study population in each group. Results: The study findings indicate that dexamethasone significantly reduces postoperative pain, as evidenced by lower VAS scores in patients administering dexamethasone compared to those receiving a placebo, especially at 6 and 24 hours post-transfer from the recovery room. Additionally, patients administering a placebo exhibit a significant demand for potent analgesia in contrast to the group receiving dexamethasone. Conclusion: The study indicated that a single-dose injection of dexamethasone 8 mg administered preoperatively for various laparoscopic procedures significantly decreases postoperative pain. Effective pain management promotes early recovery and shortens hospital stays, reducing staff stress and providing financial benefits to the institution. We recommend using dexamethasone as a safe and effective medication for alleviating postoperative pain.*

Keywords: *dexamethasone, laparoscopic surgery, Multimodal Analgesia, postoperative pain*

1. INTRODUCTION

Surgery constitutes a form of trauma inflicted upon a patient. The organism generates a metabolic and endocrine response to trauma by activating the hypothalamus-pituitary-adrenal axis and the sympathetic nervous system.(Hsiung et al., 2023) . Studies indicate that the reaction to trauma correlates with the severity of the trauma experienced. Minimizing trauma is a primary objective in surgical interventions.(Hsiung et al., 2023, Gul et al., 2020) . Laparoscopic surgery is appealing for several reasons: it is more aesthetically pleasing, results in less postoperative discomfort, necessitates a shorter hospital stay, and allows for a quicker return to normal activities and employment.(Taki-Eldin and Badawy, 2018)

The postoperative recovery after several variables, including discomfort, weariness, and exhaustion, influence laparoscopic surgery. Pain and fatigue are pronounced, particularly on the day of the procedure and the following day. Nausea and vomiting primarily manifest on the day after the operation and seldom extend the postoperative recovery period.(Gul et al., 2020)

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Surgical pain is one of the most significant issues that healthcare providers encounter every day, among surgical consequences. This discomfort may originate from a surgical site or the shoulder (referred pain). Multiple elucidations exist for discomfort after laparoscopic surgery. The most acknowledged causes are peritoneal irritation from carbon dioxide (CO_2), peritoneal inflammation, and peritoneal distension resulting from pneumoperitoneum. Medical practitioners have recommended and employed various techniques to mitigate this, including preoperative administration of opioids or opioid-sparing analgesia, clonidine, preoperative pregabalin, local anesthetic instillation at the wound site, and intraperitoneal irrigation with bupivacaine or ondansetron, along with suctioning residual gas from the peritoneum before closure. (da Silveira et al., 2024, Zheng et al., 2022, Mirhosseini et al., 2017, Trujillo-Esteves et al., 2019, Stamenkovic et al., 2021, Putta et al., 2019, Abdelaziz et al., 2021, Yang et al., 2021).

The therapy of acute surgical pain has transitioned in recent years from a primarily narcotic-based approach to a multimodal analgesia system using medications from many classes. This method, referred to as balanced analgesia, aims to minimize opioid use to mitigate adverse effects while achieving enhanced analgesic efficacy. Pain is a significant factor contributing to prolonged recovery and release delays after ambulatory surgery, as well as a frequent cause of unexpected hospital hospitalizations after operations that are typically outpatient. (Moore, 2018).

Postoperative pain management should be tailored to the specific surgical procedure, utilizing a combination of various analgesics, preferably non-opioid, to achieve additive or synergistic effects while minimizing opioid-related side effects. (Min et al., 2016, Shim, 2020, Kehlet, 2020) Glucocorticoids have shown opioid-sparing effects in multiple clinical studies regarding postoperative pain.(Bjerregaard et al., 2018, Nielsen et al., 2015, Asad and Khan, 2015, Kleif et al., 2017, Xu et al., 2020)

Glucocorticoids mitigate inflammation and tissue damage in several illnesses, such as inflammatory bowel disease, rheumatoid arthritis, and some cancers. Glucocorticoids possess significant immunomodulatory properties and are used to manage acute allograft rejection. Dexamethasone has antiemetic effects and is often used to prevent postoperative nausea and vomiting (PONV).(Dimmen et al., 2023, Jensen et al., 2020) .

Recent studies have examined the effectiveness of glucocorticoids in alleviating pain and inflammation post-surgery. Initial research on dental treatment patients indicated that glucocorticoids significantly diminished postoperative pain and swelling.(Chaudhary et al., 2015, Shibl et al., 2021, Selvido et al., 2021, Kirkham et al., 2018)

Recent studies have examined the analgesic effects of a single perioperative dose of dexamethasone, yielding inconsistent results. One of these studies done to evaluate the prophylaxis role of dexamethasone before thyroidectomy to reduce postoperative nausea, pain, and vocal dysfunction demonstrates that Dexamethasone (8 mg IV) is a safe and effective method to reduce postoperative nausea, vomiting, and pain after thyroid resection and should be used routinely.(Feroci et al., 2011) Another study was performed to assess the efficacy of preoperative dexamethasone in patients with laparoscopic cholecystectomy. It showed that intravenous dexamethasone (8 mg) preoperatively is safe without apparent side effects and significantly reduces the incidence of postoperative nausea, vomiting, pain, and fatigue after Laparoscopic cholecystectomy.(Fukami et al., 2009). Previous studies have indicated limitations in assessing the analgesic impact during laparoscopic surgery. This study aims to evaluate the analgesic effect of dexamethasone as part of a multimodal analgesia approach for postoperative pain management in various laparoscopic procedures.

2. PATIENTS AND METHODS

Study population

This prospective, comparative, randomized, double-blind study was conducted at Baghdad Teaching Hospital from January 2023 to April 2023. A total of 80 patients, aged 20 to 60, ASA I–II.(Doyle et al., 2017) Various laparoscopic operations under G.A. were included in the research.

Study design

The study population was divided into two groups: Group A, the control group, received 2ml of normal saline (placebo) before anesthesia induction, whereas Group B, the experimental group, was administered 8mg of dexamethasone one hour before anesthesia induction.

Upon the patient's arrival in the operating room, an ECG and non-invasive BPM were affixed, and the patient's condition was observed throughout the surgical procedure. The induction of general anesthesia with a standard induction agent commenced with pre-oxygenation, followed by the administration of Midazolam at 1 mg, Fentanyl at 100 µg, Ketamine at 0.5 mg/kg, Propofol at 2 mg/kg, Atracurium at 0.5 mg/kg. Anaesthesia is maintained using O_2 and isoflurane at a concentration of 1.5%, with an intravenous injection of 2 mg morphine administered 30 minutes post-induction.

The incision site was locally infiltrated with 3 ml of 1% lidocaine before the insertion of the Veress needle or trocar. Upon completion of the surgery, the operating surgeon manually compressed the patient's abdomen to expel residual CO_2 from the abdominal cavity before suturing the skin incision.**(Mishra, 2013)**

Included criteria

The study enrolled patients undergoing laparoscopic procedures aged 20–60, with BMI between 18 and 30, and with ASA I–II.

Excluded criteria

Patients with a BMI over 30, those diagnosed with diabetes, patients who had laparotomy, individuals using drugs for chronic pain, Inability to comply with the procedure, allergy to any study medication, those known to have compromised renal function, and alcohol or drug addiction, or both were excluded from the study

Estimation of pain score

The degree of pain was measured using a Visual Analogue Scale (VAS) at 1-, 3-, 6-, and 24 hours post-surgery, starting when the patient was transferred to the recovery room. Upon the patient's request for analgesia or when the VAS exceeded 4, 100 mg of nefopam was administered intravenously.

Ethical approval

The ethics committee of the University of Baghdad's College of Medicine sanctioned the research protocol, and the established guidelines were used to conduct the procedures. The patient's medical history was acquired with their agreement.

Statistical analysis

The questionnaire scores were reported using the mean and standard deviation. A t-test and the least significant difference LSD were utilized to correspond to the distinct variables in the study. The statistical significance was assessed at a significance level of $P < 0.05$ using SPSS, version 21 (SPSS Inc, Chicago, Illinois). (Mubarok and Sahroni, 2021, Jumaa et al., 2024b).

3. RESULTS

The demographic data of the study population indicated no significant differences in the distribution of gender, age, and BMI across the research groups. Furthermore, there was no significant difference in the duration of operation or anesthesia across the study groups. (Table 1-2) (figure 1-2). The gender distribution of the study population revealed that the male percentage was equal to 32.5% and 40% each in groups A and B, respectively, while the female rate was equal to 67.5 % and 60% each in groups A and B, respectively. The study population's mean age was 41.70± 11.27 and 40.25 ± 11.02 in groups A and B, respectively. The mean BMI was 24.11 ± 2.93 and 23.78 ±3.06 in groups A and B, respectively.

On the other hand, the mean duration of the surgery was 45.28 ± 9.80 min and 44.18 ± 9.93 min for each group A and B, respectively, while the mean duration of anesthesia was 62.58 ± 10.70 min and 60.63 ± 9.38 min for each group A and B, respectively. (Table 1-2) (figure 1-2).

The study revealed no significant difference in ASA grades between groups A and B for grades I and II. table (3) figure (3).

Moreover, study outcomes concluded that the impact of preoperative administration of dexamethasone was shown to significantly enhance VAS scores among patients who were administered dexamethasone compared to those who were not, mainly after 6 and 24 hours after surgery. Furthermore, the study group that received preoperative dexamethasone significantly changed the VAS score, particularly one-hour post-surgery. In comparison to the groups who did not receive dexamethasone, a significant enhancement in the VAS score was observed 6- and 24 hours post-surgery. Table (5) figure (5)

The outcomes were corroborated by the potent analgesia (nefopam) demand results, indicating that groups that administered dexamethasone preoperatively showed less requirement for analgesia for postoperative pain compared to groups that did not receive dexamethasone preoperatively, which exhibited a significant demand for strong analgesia. Table (4) figure (4)

Table (1): The demographic distribution of the study population

Demographic Data		**Group A**		**Group B**		***P*- value**
		Mean ± SD[a]	**%**	**Mean ± SD[a]**	**%**	
gender	Male	13±2.582	32.5%	16±2.898	40.0%	**0.825**
	Female	27±3.414	67.5%	24±2.582	60.0%	**0.797**
	M: F ratio	1: 2.07		1: 1.5		-
	Total	40	100.0	40	100.0	
	***P*- value**	**0.0001***	**-**	**0.0001***	**-**	-
Age (years)		41.70± 11.27		40.25 ± 11.02		**0.944**
BMI		**24.11 ± 2.93**		**23.78 ±3.06**		**0.617**

a: standard deviation, *: significant at (P<0.05)

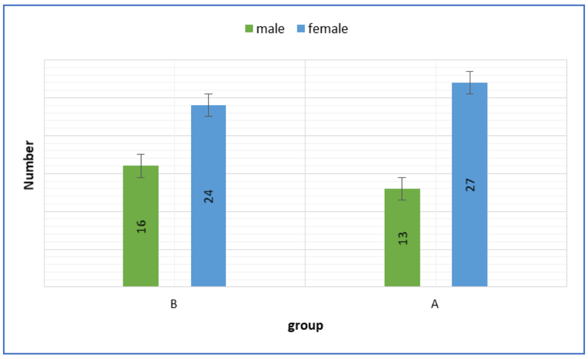

Figure (1): gender distribution of the study groups

Table (2): Surgical and anesthetic duration in study groups			
Parameter	**Duration in (min) Mean ± SD[a]**		***P*- value**
	Group A	**Group B**	
Duration of surgery	45.28 ± 9.80	44.18 ± 9.93	**0.616**
Duration of anesthesia	62.58 ± 10.70	60.63 ± 9.38	**0.383**
a: standard deviation, *: significant at (P<0.05)			

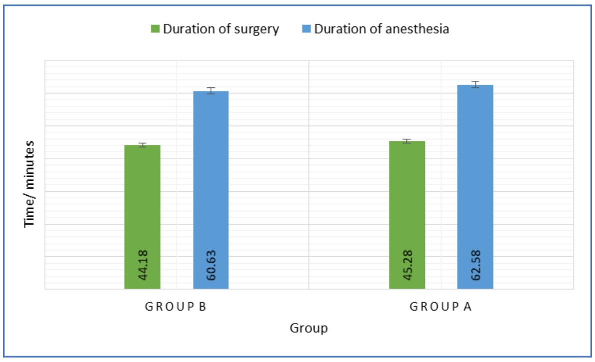

Figure (2): Surgical and anesthetic duration in study groups

Table (3): Distribution of ASA grade in study groups			
ASA grad	**Patients No Mean ± SD [a]**		***P*- value**
	Group A	**Group B**	
I	27.00±2.582	25.00±2.582	**0.102**
II	13.00±2.582	15.00±2.582	**0.100**
***P*- value**	**0.0001***	**0.0001***	
a: standard deviation, *: significant at (P<0.05)			

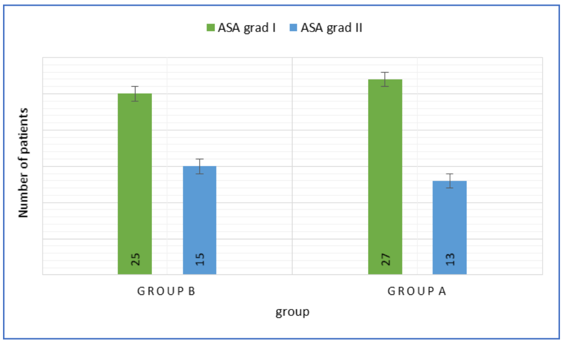

Figure (3): Distribution of ASA grade in study groups

Table (4): strong analgesia demand

Strong analgesia (nefopam)	Patients No Mean ± SD[a]		*P*- value
	Group A	Group B	
need	34.00 ± 3.362	21.00 ± 2.506	**0.007***
No need	6.00 ± 4.362	19± 1.506	**0.012***
***P*- value**	**0.002***	**0.196**	

a: standard deviation, *: significant at (P<0.05)

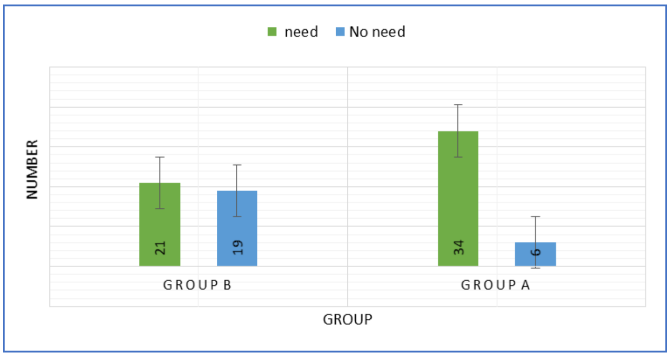

Figure (4): strong analgesia demand

Table (5): comparison of the postoperative VAS grade between study groups

Postoperative periods	VAS score Mean ± SD[a]		*P*- value
	Group A	Group A	
1 hour	**A** 4.30 ± 0.723	**A** 4.00 ± 0.607	**0.548**
3 hours	**A** 3.20 ± 1.018	**B** 2.35 ± 0.597	**0.429**
6 hours	**A** 2.80 ± 0.616	**B** 2.23 ± 0.483	**0.027***
24 hours	**B** 2.5 ± 0.599	**B** 1.79 ± 0.405	**0.043***
LSD[b]	**1.79779**	**1.373**	-

a: standard deviation, b: least significant difference, statistically significant differences are shown by variations in capital letters within the same column *: significant at (P<0.05)

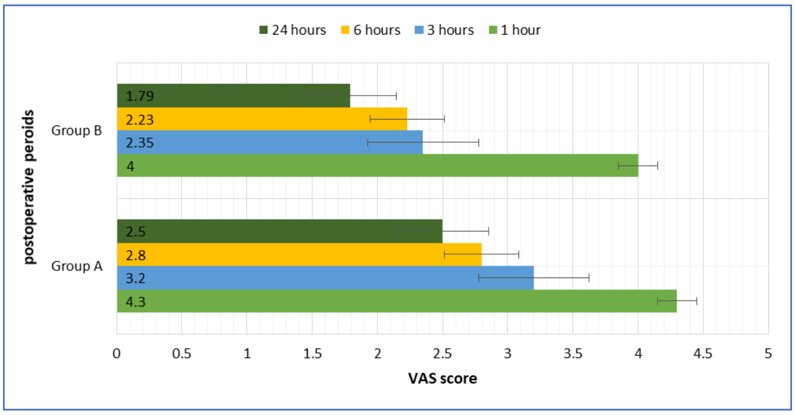

Figure (5): comparison of the postoperative VAS score between study groups

Discussion

Laparoscopic surgery is a minimally invasive approach aimed at minimizing tissue damage, postoperative pain, and hospital stay duration, facilitating early return to work, and reducing patient morbidity. Despite the recognized advantages of laparoscopic procedures over open surgery, there are particular concerns about postoperative pain, which may arise from pleural and peritoneal anatomy, potentially leading to nociceptive afferent pain signals. (Golzari et al., 2016, Coccolini et al., 2015) . Improper pain management could be associated with varied respiratory, cardiovascular, gastrointestinal, and psychological complications. Thromboembolic events could occur following reduced mobility due to postoperative pain. Furthermore, activation of stress responses can lead to water and sodium retention and an increased metabolic rate.(Kaba et al., 2007). A key advantage of laparoscopic surgery compared to open surgery is reduced postoperative pain. Strategies that alleviate pain postoperatively are essential to augment this benefit. Several methods have been employed to tackle this concern. One of these surgeries used dexamethasone. The present study was concerned with this topic.

Involving 80 patients, the present study was done to evaluate the analgesic role of dexamethasone as a part of Multimodal Analgesia for controlling postoperative pain. The study population was divided into two groups. After taking into consideration the equal distribution of age, gender, and BIM between the groups, one from these groups was given a placebo, while others were given 8 mg dexamethasone intravenously one hour before induction of anesthesia; study outcomes exhibited a significant decline in VAS score, specifically after 6 and 24 hrs. from the end of the surgery in a patient who is receiving dexamethasone preoperatively as comparing with those who given a placebo. Furthermore, the demand for strong analgesia postoperatively was seen more in patients who were given a placebo as compared with those who were given dexamethasone preoperatively.

On the same topic, a separate study assessed the efficacy of a single dose of Dexamethasone in alleviating postoperative pain in patients undergoing laparoscopic cholecystectomy. It revealed that pain intensity in the dexamethasone group was significantly lower than in the placebo group at two, six-, and twelve hours post-surgery. Furthermore, Meperidine use in the cohort administered dexamethasone was much lower than in the cohort receiving placebo. (Arora et al., 2018) The VAS score showed a drop in individuals treated with dexamethasone, especially after 48 hours, according to another study that examined the efficacy of preoperative vs. intraoperative dexamethasone in decreasing postoperative pain following laparoscopic cholecystectomy.(Lee et al., 2020, Hashim et al., 2020) Another study in the same issue indicates that administering 8 mg of dexamethasone preoperatively significantly decreases the occurrence of postoperative nausea and vomiting, pain, and fatigue following elective laparoscopic cholecystectomy. (Ashraf et al., 2024) A further study was conducted to examine the effectiveness of dexamethasone alone in managing postoperative pain compared to the combination of dexamethasone and lignocaine. The preoperative administration of a single dose of dexamethasone improved the quality of recovery score and reduced pain following laparoscopic cholecystectomy compared to a lignocaine bolus dose. (Arora et al., 2018) . Previous studies corroborated our findings; however, an alternative study indicated that the use of dexamethasone insignificantly lowers postoperative pain. This study demonstrated that administering 8 mg of dexamethasone 90 minutes before surgery had an insignificant impact on pain reduction. These findings may be associated with the prolonged duration of dexamethasone administration before surgery.(Gul et al., 2020).

Postoperative pain after laparoscopic surgery consists of both somatic and visceral elements. (El-Sherbiny et al., 2009) . Somatic pain after laparoscopic procedures is characterized by sharp, localized discomfort in the abdomen.(Chou et al., 2005) . The pain mechanisms are associated with the perforation of the abdominal wall and the placement of trocars, sutures, and tacks utilized for securing the mesh to the anterior abdominal wall.(Gough et al., 2015) . Visceral pain following laparoscopic surgery may arise from peritoneal traction or diaphragm irritation due to surgical manipulation, intraoperative gas insufflation, and postoperative gas retention.(Kaba et al., 2007, El-Sherbiny et al., 2009, Chou et al., 2005, Long et al., 2019, Hirsch et al., 2021) .Somatic sensation is precisely localized to its site of origin. The visceral sensation is characterized by vagueness, commonly associated with somatic structures, and typically radiates to one side of the body or the other.(Keefer et al., 2016, Kansal and Hughes, 2016, Greenwood-Van Meerveld and Johnson, 2018, Jumaa et al., 2024a).

Prostaglandins sensitize neurons within visceral and somatic sensation pathways to noxious or irritating stimuli, which may be chemical, thermal, or mechanical, leading to pain perception.(Briones-Vozmediano, 2017) Prostaglandin E2 (PGE2), a specific type of prostaglandin, is synthesized during inflammatory responses. Elevated levels of PGE2 contribute to key characteristics of inflammation, such as pain, edema, and fever.(Panigrahy et al., 2021, Sharif and Klimko, 2019). Based on these facts, any manipulation in the level of prostaglandins, mainly Prostaglandin E2 (PGE2), alters pain sensation. Corticosteroid drugs, particularly dexamethasone, are examples of medications that can lower the production of prostaglandin, specifically Prostaglandin E2 (PGE2).(Cacheiro-Llaguno et al., 2022, Yasin et al., 2023, Hashim et al., 2023).

Study limitations include constraints in the sample size since the research is being conducted in a confined geographical region and during a limited timeframe.

4. CONCLUSION

This study demonstrated that a single-dose injection of dexamethasone 8 mg given preoperatively for various laparoscopic procedures significantly reduces postoperative pain. Effective pain management facilitates early recovery and reduces hospital stays, alleviating staff stress and offering the trust financial benefits. We recommend dexamethasone as a safe and effective option for reducing postoperative pain.

REFERENCE

Abdelaziz, D. H., Boraii, S., Cheema, E., Elnaem, M. H., Omar, T., Abdelraouf, A., & Mansour, N. O. (2021). The intraperitoneal ondansetron for postoperative pain management following laparoscopic cholecystectomy: A proof-of-concept, double-blind, placebo-controlled trial. *Biomedicine & Pharmacotherapy, 140,* 111725. https://doi.org/10.1016/j.biopha.2021.111725

Arora, P., Khurana, G., & Sachan, P. K. (2018). Comparison of postoperative quality of recovery and pain relief with preoperative single-dose dexamethasone and lignocaine after laparoscopic cholecystectomy. *Anesthesia Essays and Researches, 12*(3), 630–635. https://doi.org/10.4103/aer.AER_115_18

Asad, M. V., & Khan, F. A. (2015). Effect of a single bolus of dexamethasone on intraoperative and postoperative pain in unilateral inguinal hernia surgery. *Journal of Anaesthesiology Clinical Pharmacology, 31*(3), 339–343. https://doi.org/10.4103/0970-9185.161666

Ashraf, R., Shah, A., Naseem, U., Awan, M. N., & Naz, F. (2024). Comparison of dexamethasone-diphenhydramine and dexamethasone-ondansetron in preventing postoperative nausea and vomiting after laparoscopic cholecystectomy. *Journal of Islamabad Medical & Dental College, 13*(3), 210–216.

Bjerregaard, L. S., Jensen, P. F., Bigler, D. R., Petersen, R. H., Møller-Sørensen, H., Gefke, K., Hansen, H. J., & Kehlet, H. (2018). High-dose methylprednisolone in video-assisted thoracoscopic surgery lobectomy: A randomized controlled trial. *European Journal of Cardio-Thoracic Surgery, 53*(2), 209–215. https://doi.org/10.1093/ejcts/ezx300

Briones-Vozmediano, E. (2017). The social construction of fibromyalgia as a health problem from the perspective of policies, professionals, and patients. *Global Health Action, 10*(1), 1275191. https://doi.org/10.1080/16549716.2017.1275191

Cacheiro-Llaguno, C., Hernández-Subirá, E., Díaz-Muñoz, M. D., Fresno, M., Serrador, J. M., & Íñiguez, M. A. (2022). Regulation of cyclooxygenase-2 expression in human T cells by glucocorticoid receptor-mediated transrepression of nuclear factor of activated T cells. *International Journal of Molecular Sciences, 23*(22), 13275. https://doi.org/10.3390/ijms232213275

Chaudhary, P. D., Rastogi, S., Gupta, P., Indra, B. N., Thomas, R., & Choudhury, R. (2015). Pre-emptive effect of dexamethasone injection and consumption on post-operative swelling, pain, and trismus after third molar surgery: A prospective, double-blind, and randomized study. *Journal of Oral Biology and Craniofacial Research, 5*(1), 21–27. https://doi.org/10.1016/j.jobcr.2014.11.002

Chou, Y.-J., Ou, Y.-C., Lan, K.-C., Jawan, B., Chang, S.-Y., & Kung, F.-T. (2005). Preemptive analgesia installation during gynecologic laparoscopy: A randomized trial. *Journal of Minimally Invasive Gynecology, 12*(4), 330–335. https://doi.org/10.1016/j.jmig.2005.05.011

Coccolini, F., Catena, F., Pisano, M., Gheza, F., Fagiuoli, S., Di Saverio, S., Leandro, G., Montori, G., Ceresoli, M., & Corbella, D. (2015). Open versus laparoscopic cholecystectomy in acute cholecystitis: Systematic review and meta-analysis. *International Journal of Surgery, 18*, 196–204. https://doi.org/10.1016/j.ijsu.2015.04.083

Da Silveira, C. A., Rasador, A. C., Medeiros, H. J., Slawka, E., Gesteira, L., Pereira, L. C., & Amaral, S. (2024). Opioid-free anesthesia for minimally invasive abdominal surgery: A systematic review, meta-analysis, and trial sequential analysis. *Canadian Journal of Anesthesia/Journal Canadien d'anesthésie*. https://doi.org/10.1007/s12630-024-02349-4

Dimmen, A., Timko, S., Greenwood, J., McShane, F., & Ulinski, J. (2023). Effect of dexamethasone administration for postoperative nausea and vomiting prophylaxis on glucose levels in adults with diabetes undergoing elective surgery: A systematic review with meta-analysis. *JBI Evidence Synthesis, 21*(11), 2156–2187. https://doi.org/10.11124/JBIES-23-00025

Doyle, D. J., Hendrix, J. M., & Garmon, E. H. (2017). American Society of Anesthesiologists classification.

El-Sherbiny, W., Saber, W., Askalany, A. N., El-Daly, A., & Sleem, A. A.-A.-A. (2009). Effect of intra-abdominal instillation of lidocaine during minor laparoscopic procedures. *International Journal of Gynecology & Obstetrics, 106*(3), 213–215.

Feroci, F., Rettori, M., Borrelli, A., Lenzi, E., Ottaviano, A., & Scatizzi, M. (2011). Dexamethasone prophylaxis before thyroidectomy to reduce postoperative nausea, pain, and vocal dysfunction: A randomized clinical controlled trial. *Head & Neck, 33*(6), 840–846.

Fukami, Y., Terasaki, M., Okamoto, Y., Sakaguchi, K., Murata, T., Ohkubo, M., & Nishimae, K. (2009). Efficacy of preoperative dexamethasone in patients with laparoscopic cholecystectomy: A prospective randomized double-blind study. *Journal of Hepato-Biliary-Pancreatic Surgery, 16*(3), 367–371.

Golzari, S. E., Nader, N. D., & Mahmoodpoor, A. (2016). Underlying mechanisms of postoperative pain after laparoscopic surgery. *JAMA Surgery, 151*(3), 295–296.

Gough, A. E., Chang, S., Reddy, S., Ferrigno, L., Zerey, M., Grotts, J., Yim, S., & Thoman, D. S. (2015). Periprosthetic anesthetic for postoperative pain after laparoscopic ventral hernia repair: A randomized clinical trial. *JAMA Surgery, 150*(9), 835–840.

Greenwood-Van Meerveld, B., & Johnson, A. C. (2018). Mechanisms of stress-induced visceral pain. *Journal of Neurogastroenterology and Motility, 24*(1), 7–20.

Gul, G., Bilgic, T., & Aydin, M. A. (2020). Evaluation of the effects of preoperative dexamethasone administration on postoperative patient comfort in laparoscopic cholecystectomy. *Cureus, 12*(1),

Hashim, W. S., Jumaa, A. H., Alsaadi, N. T., & Arean, A. G. (2020). Physiological study comprising the sequelae of magnetic radiation on humans. *Indian Journal of Forensic Medicine & Toxicology, 14*(3), 421–425.