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THE IMPACT OF INTRA-PERITONEAL SUB-DIAPHRAGMATIC INSTILLATION OF LOCAL ANESTHESIA ON REDUCING SHOULDER TIP PAIN AFTER LAPAROSCOPIC SURGERY

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ABSTRACT

Objective: to assess the effectiveness of local anesthesia instillation in the subdiaphragmatic area in decreasing the shoulder tip pain after laparoscopic surgery. **Methodology:** A retrospective comparative study of 240 patients who underwent laparoscopic procedures specifically (Nissen fundoplication, sleeve gastrectomy, and laparoscopic cholecystectomy). The study was conducted at King Hussien Medical Center over a one-year duration from Jan to Dec 2025. Since it's a comparative study, we classified patients into group A (n=120) who received intraperitoneal local anesthesia and group B (n=120) who underwent surgery without local instillation. Technique: injection of 20 ml of 0.5% bupivacaine (Marcaine) in the Sub-Diaphragmatic region at the end of the laparoscopic procedure (before deflation), taking in considerations the maximum safe dose of bupivacaine <2 mg per Kg. The source of patients' information and medical records was obtained from the electronic medical program HAKEEM. All procedures were performed at King Hussien Medical Center and by the bariatric and laparoscopic surgical team. All data, including demographic (age and gender), types of procedures (Nissen fundoplication, sleeve gastrectomy, and cholecystectomy), intra-operative laparoscopic parameters (flow rate of CO2, intra-abdominal pressure, and the procedure time-length) were observed and recorded. After surgery, all patients were observed to assess the post-operative pain in the 1st 12 hours. The Numeric Rating Scale (NRS, 0-10) was recorded for both groups. The data were analyzed statistically by SPSS IBM software version 28. **Results:** A total of 240 patients, 50% received the intra-peritoneal, subdiaphragmatic local anesthesia instillation and were grouped A, the another 50% didn't receive the drug. Regarding demographic features, there were no significant differences in age, sex, or comorbidities, An 130 patients underwent sleeve gastrectomy (Group A =80, Group B =50), 100 (Group A =30, Group B =70), patients underwent laparoscopic cholysystectomy and 10 patients only underwent nissen fundoplication, (Group A =4, Group B =6), a 12 hours after surgery, the Numeric Pain Score (NPS) showed a significant difference in favor of Group A. As shown in Table 1, the mean + SD was 2.2+1 for Group A and 4.8+1.4 for Group B, with a significant P-value (P<0.001). **Conclusion:** Local anesthesia instillation inside the peritoneal cavity and in the subdiaphragmatic area significantly reduces the postoperative abdominal pain and shoulder tip pain after laparoscopic procedures.

INTRODUCTION

Minimally invasive surgery is a surgical technique that aims to reduce the operative time and improve postoperative recovery. The Era of laparoscopic surgery is becoming the most favorable mode of intervention for both patients and surgeons. Most of the major surgeries, like bariatric surgery, anti-reflux surgery, and ventral hernia, are performed laparoscopically and carry a lower risk for infection, bleeding, and pain after the procedures.[1,2]

The pain after surgery is the most fearsome complication for patients. Because of that most anesthesiologists try to give analgesics to decrease these symptoms. There are many techniques used to relieve pain after surgery through parenteral injections or subcutaneous local

anesthesia. We are considering in our study to inject the local anesthesia inside the peritoneal cavity, especially in the case of upper gastrointestinal tract surgery (UGIT), taking advantage of the laparoscopic nature and the accessibility of the drug instillation.[3,4]

Shoulder tip pain after CO2 gas abdominal inflation is the most common abdominal pain, caused by diaphragmatic overdistension, which was absent in the traditional open surgery. These pain signals irritate the phrenic nerve and radiate to the shoulder. The idea is block the afferent pathways and then reduce the pain after the laparoscopic procedures.[5]

Therefore, the main goal of our study is to assess the effectiveness of local anesthesia instillation in the sub-diaphragmatic region in order to relieve the pain caused by diaphragmatic distension.

METHODOLOGY

A retrospective comparative study of 240 patients who underwent laparoscopic procedures specifically (Nissen fundoplication, sleeve gastrectomy, and laparoscopic cholecystectomy). The study was conducted at King Hussien Medical Center over a one-year duration from Jan to Dec 2025. Since it's a comparative study, we classified patients into group A (n=120) who received intraperitoneal local anesthesia and group B (n=120) who underwent surgery without local instillation.

Inclusion criteria: all patients who underwent the laparoscopic sleeve gastrectomy, Nissen fundoplication, and cholecystectomy from January 2025 to 30th of Dec-2025. While open surgeries, complicated laparoscopic procedures and prolonged procedures were excluded from our study.

Technique: injection of 20 ml of 0.5% bupivacaine (Marcaine) in the Sub-Diaphragmatic region at the end of the laparoscopic procedure (before deflation), taking in considerations the maximum safe dose of bupivacaine <2 mg per Kg. The source of patients' information and medical records was obtained from the electronic medical program HAKEEM. All procedures were performed at King Hussien Medical Center and by the bariatric and laparoscopic surgical team. All data, including demographic (age and gender), types of procedures (Nissen fundoplication, sleeve gastrectomy, and cholecystectomy), intra-operative laparoscopic parameters (flow rate of CO2, intra-abdominal pressure, and the procedure time-length) were observed and recorded.

After surgery, all patients were observed to assess the post-operative pain in the 1st 12 hours. The Numeric Rating Scale (NRS, 0-10) was recorded for both groups. The data were analyzed statistically by SPSS IBM software version 28.

Ethical approval: the study is approved for publication be Royal Medical Service Ethical Committee under number 46.03/2026.

RESULTS

A total of 240 patients, 50% received the intra-peritoneal, subdiaphragmatic local anesthesia instillation and were grouped A, the another 50% didn't receive the drug. Regarding demographic features, there were no significant differences in age, sex, or comorbidities, As shown in Fig 1.

130 patients underwent sleeve gastrectomy (Group A =80, Group B =50), 100 (Group A =30, Group B =70), patients underwent laparoscopic cholysystectomy and 10 patients only underwent nissen fundoplication, (Group A =4, Group B =6), As shown in Fig 2.

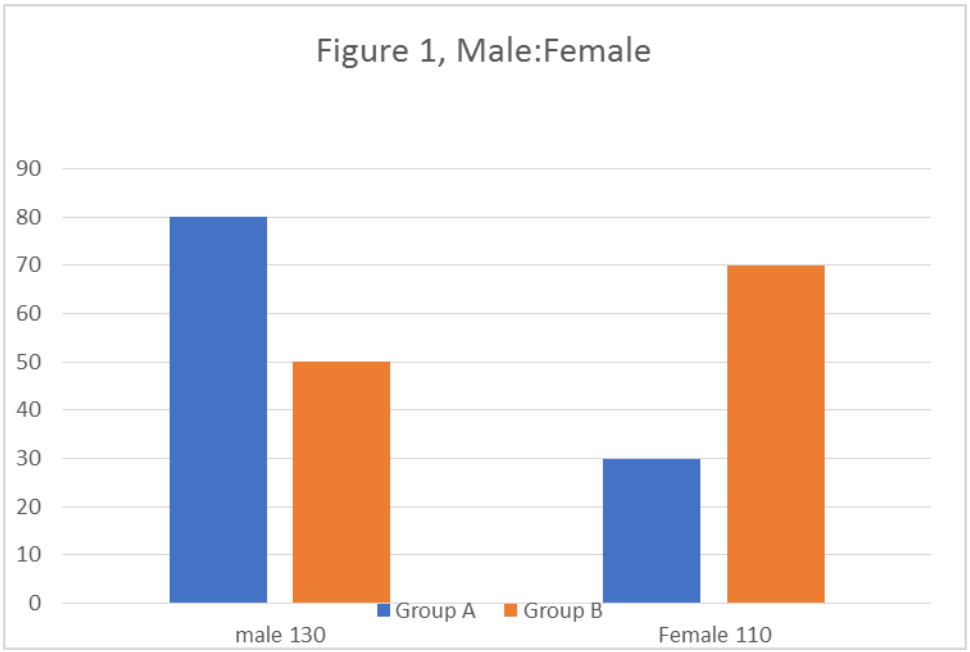
12 hours after surgery, the Numeric Pain Score (NPS) showed a significant difference in favor of Group A. As shown in Table 1, the mean + SD was 2.2+1 for Group A and 4.8+1.4 for Group B, with a significant P-value (P<0.001).

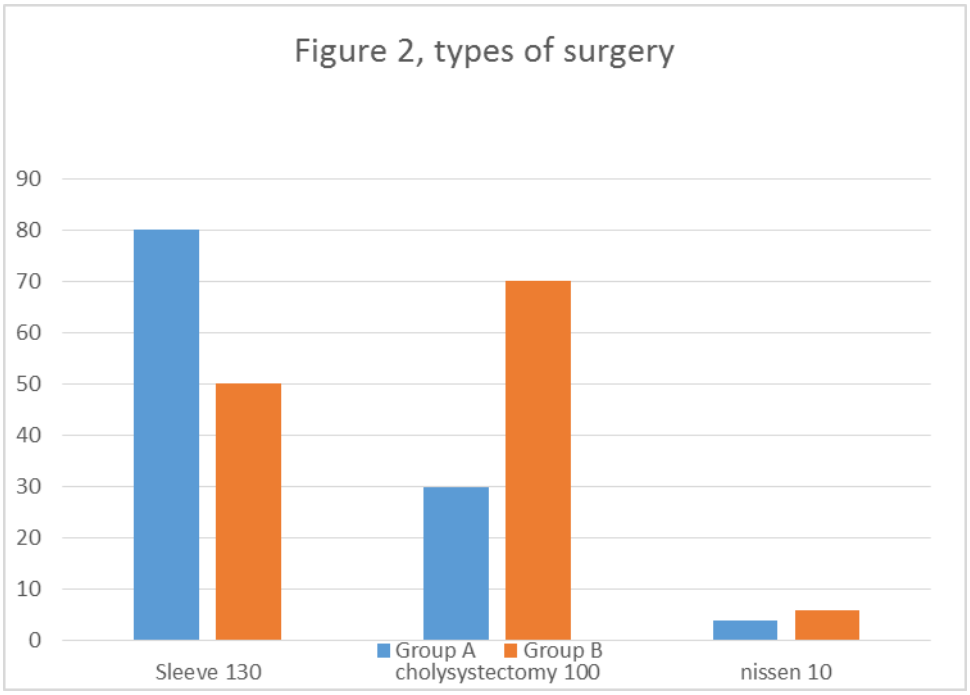
The confidence interval (CI) was 95% with a mean difference of 2.4, and a significant P value of less than 0.001. (Table1).

Table 1.

Variables	total	Group A	Group B	P-Value
gender	N=240 Male=130 Female=110	N=120 Male=80 Female=40	N=120 Male=50 Female=70	0.064
Sleeve gastrectomy	N=130	Group A=80	Group B=50	0.34
cholecystectomy	N=100	Group A=30	Group B=70	0.23
nissen	N=10	Group A=4	Group B=6	0.42
NPS*	N=240	2.2+1	4.8+1.4	0.001

*NPS: Numerical pain score (0-10).





DISCUSSION

Shoulder tip pain is a recognized complication after CO2 insufflation caused by phrenic nerve irritation and radiates to the shoulder as described by Panditrao, M. M in 2025. The same justification was also published in 2021 in the International Journal of Surgery by Batalia, A., Shrivastava, Y., & Ketkar, M.[1,2]

Local Anesthesia was used to be injected into the wound and skin to alleviate the pain after surgery, but the need for a more comfortable journey after surgery create more powerful pathway for drug injection, especially in the era of laparoscopic surgery. In the past, most of the surgical procedures were performed under open techniques; there was no need for the creation of pneumoperitoneum and diaphragmatic distension. But nowadays most abdominal operation performed under a laparoscopic technique, which involves the use of certain medications to reduce the pain that originates from diaphragmatic overdistension, as described by Liu, L., Xia, T., Ji, H., Guo, Y., Liu, and Kammar, P. S in 2021.[3,4]

In 2018, the Egyptian Journal of Anesthesia published an article about bupivacaine instillation in the subdiaphragmatic region, Mostafa, R. H., & Mekki, Y. M. H showed a significant improvement in pain reduction after laparoscopic cholecystectomy. The results were nearly like our results.[5,6]

On the other hand, the intraperitoneal infiltration with local anesthesia may reduce the abdominal pain after laparoscopic surgery, but it didn't affect the shoulder tip pain, Malallah, Z. Z., & Al-Mafrachi, K. K, said in (2022). These findings are not typically like our results, and that may be due to their small sample limitation.[7]

The strongest study in this field was published in World Journal of Gastroenterology by Choi, G. J., Kang, H., Baek, C. W., Jung, Y. H., & Kim, D. R in 2015. This Meta-analysis study involved more than 200 articles and finally they concluded that the infiltration of local anesthesia dramatically reduces the postoperative pain.[8-13]

CONCLUSION

Local anesthesia instillation inside the peritoneal cavity and in the subdiaphragmatic area significantly reduces the postoperative abdominal pain and shoulder tip pain after laparoscopic procedures.

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