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Incidence of postoperative complications in the first 24 hours: A retrospective cohort study in Saudi Arabia

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ABSTRACT

Background: Postsurgical complication considers highly common for both patients and surgical teams. The complication depends on multi factor related to the patient health profile and the experience of the surgeon along with operation state emergency or elective. *Objectives:* We aimed to assess the rate and incidence of postoperative complications during the first 24 hours after general surgery in the Saudi population and to identify the key predictors for early post-operative complications. *Methods:* A retrospective record review was conducted from case files of 1,005 patients who underwent laparoscopic, open and conversion-approach surgeries at King Abdul- Aziz University Hospital. *Results:* Most of the surgical procedures conducted in the general surgery department as open approach sub-type (n=583, 58.3%) while laparoscopic surgeries were the second most common (n=327, 32.7%). The open approach was the most significant approach it was more common among patients with diabetes ($p<0.017$, n=166). The most common postoperative complications related to the open approach were post-op constipation ($p<0.005$, n=119), neurological complications ($p<0.039$, n=10) and surgical site complications ($p<0.014$, n=1). The post-operative complications in the laparoscopic approach as post-op constipation ($p<0.004$, n=72) and surgical site complications ($p<0.032$, n=72). In diabetes, post-operative surgical complications ($p<0.002$, n=7), surgical site complications and neurological complications ($p<0.003$, n=6) are common. *Conclusion:* The open approach has been more affected than laparoscopic in our study by the risk factors related to comorbidity in Saudi Arabian patients. Need to assess the post-operative complication state combined with the newer minimally invasive surgical procedures as multicenter studies.

Keywords: Postoperative complications, open approach, laparoscopic approach, infection.

1. INTRODUCTION

Postsurgical complications are highly common events for both patients and surgical teams. Postoperative complications are any unfavorable and/or unexpected events that occur post-surgery and impose a high risk on patients in terms of treatments and/or outcomes (Woodfield et al., 2016). The incidence of postoperative complications varies among procedures and depends on numerous factors that influence patient outcomes. Recent studies have shown that the incidence of postoperative complications in the first 24 hours after general surgery is 5% (Diener et al., 2011; Ironside et al., 2018). The most common complications encountered in this period are pain, fever, bleeding, atelectasis and lung collapse, acute kidney injury, nausea and vomiting (National Institute for Health and Care Excellence, 2020). The incidence of these complications was found to be 55.3%, 20–90%, 0.4– 2%, 5–10%, 40%, 30%-40% and respectively (Mwaka et al., 2013; Abdelmaseeh et al., 2021; Dilek et al., Hooper et al., 2021; Kelkar, 2015; Shaikh et al., 2016).

The degree of severity of the operation, the pathological condition and the comorbidity of the patients can influence the outcomes and increase the frequency of complications. Bawa et al., (2021) reported that postoperative complications occurred in 11.2% of patients that underwent thyroid surgery. Interestingly, a lower incidence of complications was associated with well-trained and skillful surgeons.

The most critical period for developing complications is the first 24 hours after surgery. Moreover, this period plays an important role in determining the patients' final outcomes after surgery. Therefore, close follow-up of the patients, in addition to recognizing the high-risk patients, has a positive impact on the health status of Patients and subsequently their quality of life General surgery in Saudi Arabia are witnessing continuously advancements. Thus, addressing the associated complications can prevent future morbidities. Data regarding surgery-associated complications is lacking among the Asian population and particularly in Jeddah, Saudi Arabia. In this study, we aimed to assess the rate and incidence of postoperative complications during the first 24 hours after general surgery in the Saudi Arabian population and to identify the key predictors for early post-operative complications.

2. METHODS

This study was approved by the institutional review board of King Abdul-Aziz University Hospital (KAUH) in Jeddah, Saudi Arabia, Code: 621-18. A retrospective record review was conducted from the case files of 1,005 patients who were randomly selected out of all the patients that underwent laparoscopic, open and conversion-approach surgeries with their sub-types in the Department of General Surgery, Faculty of Medicine, at KAUH from 2013 up to 2021 using Excel randomizer. Sex, age, procedure sub-type, type of surgery (laparoscopic, open and conversion), date of admission, accompanying diseases, temperature, pre and post-operative white blood cell (WBC) counts and the incidence of post-operative complications (Table 1). The exclusion criterion was patients who were receiving conservative medical therapy.

Table 1 Descriptive data for the factors and their complication states

Factors	Complications	No complications
Post-op statue vomiting	45 (4.5%)	960 (95.5%)
Post-op statue nausea	40 (4%)	965 (96%)
Post-op statue loss of conscious	11 (110%)	994 (98.9%)
Post-op statue oliguria	5 (0.5%)	1000 (99.5%)
Post-op statue constipation	230 (20.2%)	802 (79.8%)
Post-op statue upper respiratory track symptoms	1 (0.1%)	1004 (99.9%)
Post-op statue sepsis	13 (1.3%)	992 (98.7%)
Surgical site complication	12 (1.2%)	993 (98.8%)
Pulmonary complication	5 (0.5%)	1000 (95.5%)
Genitourinary complication	0.04 (0.4%)	1001 (99.6%)
Cardiac complication	5 (0.5%)	1000 (99.5%)
Neurological complication	10 (1%)	995 (99%)
Git complication	3 (0.3%)	1002 (99.7%)
Unseal pain	30 (3%)	975 (97%)
Laparoscopic cholecystectomy	123 (12.2%)	882 (87.8%)

Exploratory laparotomy	57 (5.7%)	984 (94.3%)
Laparoscopic gastric reduction	29 (2.9%)	976 (97.1%)
Laparoscopic appendectomy	30 (3%)	975 (97%)
Cholecystectomy	19 (1.9%)	986 (98.1%)
Breast excision	38 (3.8%)	967 (96.2%)
Open	706 (70.2%)	299 (29.8%)
Laparoscopic	275 (27.4%)	730 (72.6%)
Conversion	4 (0.4%)	1001 (99.6%)
Renal failure	7 (0.7%)	998 (99.3%)
Previous dialysis	5 (0.5%)	1000 (99.5%)
Pre-operative sepsis	5 (0.5%)	1000 (99.5%)
Peripheral vascular diseases	2 (0.2%)	1003 (99.8%)
History stork	2 (0.2%)	1003 (99.8%)
Gastro esophageal reflux disease	11 (1.1%)	994 (98.9%)
Dyslipidemia	28 (2.8%)	997 (97.2%)
Obstructive sleep apnea	6 (0.6%)	999 (99.4%)
Steroid use	3 (0.3%)	1002 (99.7%)
Kidney disease	11 (1.1%)	994 (98.9%)
Copd	4 (0.4%)	1001 (99.6%)
Tb	6 (0.6%)	999 (99.4%)
Smoking	82 (8.2%)	923 (91.8%)
Blood transfusion	41 (4.1%)	964 (95.9%)
Ulcerative colitis	3 (0.3%)	1002 (99.7%)
Crohn's disease	8 (0.8%)	997 (99.2%)
Heart dieses	30 (3%)	975 (97%)
Sickle cell anemia	5 (0.5%)	1000 (99.5%)
Hypertension	202 (20.1%)	803 (79.9%)
Diabetes	216 (21.5%)	789 (78.5%)

Identifying the surgery type as laparoscopic, open or conversion depended on the etiology of the disease, time of presentation to ER, stability of the patient, quick initial diagnosis by the surgery team on call at the time of presentation and admission either to the operation room (urgent case) or the surgical ward (after stabilization in the ER department while receiving pain killers and appropriate management until the morning for elective cases).

Statistical analysis

Statistical analysis was performed using SPSS software (Version 21, IBM Armonk, NY and USA). Quantitative data are presented as mean ± standard deviation. A p-value less than 0.05 were considered statistically significant.

Table 2 The operation type and related comorbidities

Kind of operation or comorbidity	Factor	p-value	Number
Laparoscopic	Diabetes	0.024	46
	Blood transfusion	0.026	5
	GERD	0.042	6
	Surgical site complication	0.032	0
	Post-op statue No pass of gas or bowel contain	0.004	72
Open	Diabetes	0.017	166
	Surgical site complication	0.014	1
	Blood transfusion	0.031	35

	Complete obstruction	Less than 0.05	119
	Neurological complication	0.039	10
Conversion	Post-op statue No pass of gas or bowel contain	0.006	3
Laparoscopic gastric reduction	Copd	0.011	1
	Genitourinary complication	0.002	1
Laparoscopic appendectomy	Tb	0.048	1
Excision of the breast	Open	0.008	4
DM	COPD	0.009	3
	TB	0.007	4
	Neurological complication	0.003	6
	Surgical site complication	0.002	7

3. RESULTS

Most of the surgical procedures conducted in the General Surgery Department were the open approach sub-type (n=583, 58.3%). The most common procedures were hernia repairs (n=91, 9.1%), procedures of the skin and soft tissue (n= 78, 7.8%), local excision of a breast lesion (n=48, 4.8%) and exploratory laparotomy (n=39, 3.9%). The other procedures mentioned in Tables 3, 4, and 5 (n=95, 9.5%) were excluded from the open approach because they were conducted in other surgical departments.

Table 3 The descriptive data of open-surgery procedures, part 1

Name of the procedure	Number	Percentage (%)
Hernia Repair	91	9.1%
Procedures of skin and subcutaneous tissue and other sites involving soft tissue	78	7.8%
Local excision of lesion of breast with or without frozen section biopsy	48	4.8%
Laparotomy	39	3.9%
Mastectomy	22	2.2%
Excision or incision of anal fistula	19	1.9%
Hemorrhoidectomy	18	1.8%
Local excision of lesion of stomach and other procedures on stomach	18	1.8%
Excision or incision of pilonidal sinus or cyst	16	1.6%
Incision or excision of anal fissure	15	1.5%
Lipectomy	15	1.5%
Total thyroid lobectomy, Thyroidectomy or Para thyroidectomy	14	1.4%
Below knee amputation	10	1%
Wedge resection of ingrown finger or toenail	10	1.0%
Hepatic enterostomy	10	1.0%
Excision of lymph node of axilla, groin, neck or inguinal area	10	1.0%
Amputation of toe with or without metatarsal bone	9	0.9%
Appendicectomy	9	0.9%
Biopsy of lymph node	7	0.7%
Examination of anal fistula wound with or without anesthesia	7	0.7%

Closure of another stoma of small or large intestine	6	0.6%
Above knee amputation	5	0.5%
Closure of loop ileostomy	5	0.5%
Cholecystectomy	4	0.4%
Open biopsy of breast	4	0.4%
Incision and drainage of breast	4	0.4%
Cyst Excision	4	0.4%
Radical excision of ingrown toenail bed	4	0.4%
Colostomy	4	0.4%
Subtotal gastrectomy	4	0.4%
Excision of lipoma	3	0.3%
Localizations of lesion of breast	3	0.3%
Drainage of perianal abscess	3	0.3%
Insertion of anal seton	3	0.3%
Per anal full thickness excision of anorectal lesion tissue	3	0.3%

Table 4 The descriptive data of open-surgery procedures continued, part 2

Name of the procedure	Number	Percentage (%)
Gastric bypass	3	0.3%
Revision of gastric band	3	0.3%
Low restorative anterior resection of rectum with coloanal or extra peritoneal anastomosis	3	0.3%
Debridement of ischemic lower limb	2	0.2%
Excision of umbilical granuloma	2	0.2%
Repair of another vein by direct anastomosis	2	0.2%
Resection of endotracheal lesion with anastomosis	2	0.2%
Sebaceous adenoma and Sebaceous cyst excision	2	0.2%
Ulcer debridement, podiatry	2	0.2%
Rectosigmoidectomy with formation of stoma	2	0.2%
Anorectal examination	1	0.1%
Anterior chest wall, mass excision (right side)	1	0.1%
Aspiration of abscess of skin and subcutaneous tissue	1	0.1%
Dressing of wound	1	0.1%
Biopsy of abdominal wall or umbilicus	1	0.1%
Re closure of postoperative disruption of abdominal wall	1	0.1%
Removal of pin, screw or wire, not elsewhere classified	1	0.1%
Biopsy of thyroid gland	1	0.1%
Core biopsy of breast	1	0.1%
Fine needle biopsy of breast	1	0.1%
Malignant neoplasm of central portion of breast	1	0.1%
Removal of breast tissue expander and	1	0.1%

insertion of permanent prosthesis		
Segmental resection of breast	1	0.1%
Direct repair of anal sphincter	1	0.1%

Table 5 The descriptive data of open-surgery procedures continued, part 3

Name of the procedure	Number	Percentage (%)
Left lateral sphincterotomy	1	0.1%
Necrotizing fasciitis, pelvic region and thigh	1	0.1%
Removal of sternal wire	1	0.1%
Rubber band ligation of hemorrhoids	1	0.1%
Total colectomy with ileostomy	1	0.1%
Right hemicolectomy with formation of stoma	1	0.1%
Malignant neoplasm of sigmoid colon	1	0.1%
Subtotal colectomy with anastomosis	1	0.1%
Gastric reduction	1	0.1%
Esophagogastric myotomy	1	0.1%
Esophagectomy	1	0.1%
Gastric sleeve	1	0.1%
Gastrotomy	1	0.1%
Hepatic enterostomy	1	0.1%
Removal of plate, rod or nail	1	0.1%
Intranasal removal of polyp from frontal sinus	1	0.1%
Excision of anal polyp	1	0.1%
Re-amputation of amputation	1	0.1%
Reiteration on sternum involving reopening of mediastinum	1	0.1%
Excision tissue expander	1	0.1%
Exploratory thoracotomy	1	0.1%
Gastric lavage	1	0.1%

The laparoscopic surgeries (n=327, 32.7%) were the most common type of operations with the following subtypes: Laparoscopic cholecystectomy (n=154, 15.4%), laparoscopic appendicectomy (35, 3.5%), laparoscopic gastric reduction (n=30, 3%) and laparoscopic exploratory laparotomy (n=19, 1.9%) (Table 6). The open approach was the most in addition, it was more common with diabetes ($p<0.017$, n=166).

Table 6 The descriptive data for laparoscopic procedures

Name of the procedure	Number	Percentage (%)
Laparoscopic cholecystectomy	154	15.4%
Laparoscopic appendicectomy	35	3.5%
Laparoscopic gastric reduction	30	3.0%
Laparoscopic exploratory laparotomy	19	1.9%
Laparoscopic gastric bypass	16	1.6%
Laparoscopic repair of hernia	9	0.9%
Right or left hemicolectomy with anastomosis	9	0.9%
Lung and pleura procedures	8	0.8%
Pancreatic procedures	7	0.7%
Resection of liver lesion	7	0.7%
Abdominoperineal proctectomy	3	0.3%
Repair of common bile duct	3	0.3%

Resection of small or large intestine with formation of stoma	3	0.3%
Removal of lesion of mediastinum	3	0.3%
LAP Gastric Sleeve	3	0.3%
Thoracoscopy endoscopy pulmonary decortication bronchoscopy	2	0.2%
Fundoplasty, laparoscopic approach	2	0.2%
Laparoscopy with biopsy	2	0.2%
Mediastinoscopy with or without Thymectomy	2	0.2%
Incisional biopsy of right sided chest wall lesion	1	0.1%
Biopsy of peritoneum	1	0.1%
Cervical esophagectomy	1	0.1%
esophagogasrtric myotomy, laparoscopic approach, with fundoplasty	1	0.1%
Insertion and fixation of indwelling peritoneal catheter for long term peritoneal dialysis	1	0.1%
Intestinal adhesions (bands) with obstruction	1	0.1%
Right hepatectomy	1	0.1%
Rigid sigmoidoscopy	1	0.1%
Thoracic surgical sympathectomy	1	0.1%
Total gastrectomy and insertion of feeding jejunostomy tube	1	0.1%

The most common post-operative complications related to open-approach surgery were complete obstruction after operation as (p<0.005, n=119), neurological complications (p<0.039, n=10) and surgical site complications (p<0.014, n=1). Blood transfusion was associated with the open approach, with a significant p-value (p<0.031, n=35).

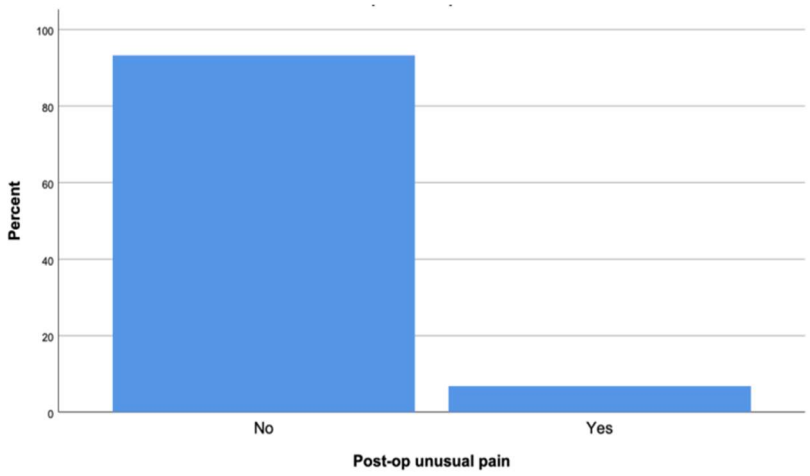

Figure 1 Post-operative unusual pain vs. percent

Additionally, the laparoscopic approach was positively associated with patients with diabetes (p<0.024, n=46). The post-operative complications with the laparoscopic approach with complete obstruction after operation as (p<0.004, n=72), surgical site complications (p<0.032, n=72) and GERD (p<0.042, n=6). Blood transfusion was associated with the laparoscopic approach (p<0.031, n=35). The surgical compilations have a strong p-value (P<0.002, n=7) as surgical site infection among the diabetic patient. On the other hand, there is a neurological complication as a post-op among them (p<0.003, n=6).

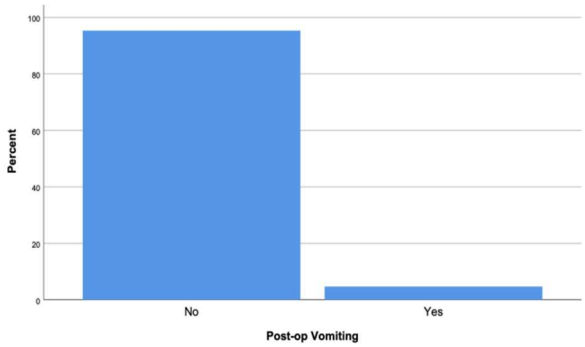

Figure 2 Post-operative vomiting vs. percent

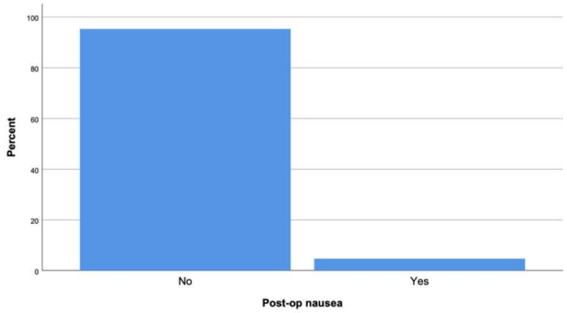

Figure 3 Post-operative nausea vs. percent

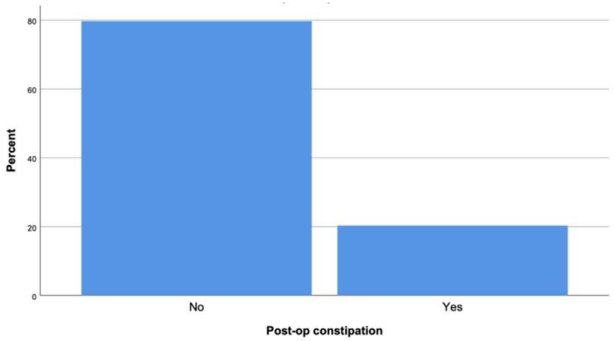

Figure 4 Post-operative constipation vs. percent

4. DISCUSSION

Post-operative complications may have a negative impact on patients' quality of life and can lead to death. Numerous studies have examined the risk factors for post-operative complications associated with different operations including a range of factors, such as the characteristics of the patient and any coexisting illnesses, the type of procedure and the level of care. According to previous reports, comorbidities are predictors of post-operative complications in patients undergoing surgery (Kim et al., 2008; Jeong et al., 2010). It is still unclear; however, which comorbidities in individuals who undergo gastrectomy are most strongly associated with the development of post-operative complications. The risk undoubtedly varies between abdominal (surgical) and non-abdominal (medical) post-operative complications.

Additionally, patients with diabetes had more unfavorable outcomes from surgery, as 21.5% of them suffered from post-operative complications. This poses a serious problem as more than half of patients with diabetes are predicted to undergo at least one surgical procedure in their life time (Sudhakaran and Surani, 2015). Post-operative complications prolong the duration of hospital stays. Our study revealed that post-surgical complications occurred in 70.2% of the open surgeries and 27.4% of the laparoscopic procedures. In numerous settings involving gastrointestinal surgeries, there is evidence that the minimal surgical trauma associated with the laparoscopic technique led to a noticeably shorter duration of hospital stays, lower level of postoperative discomfort and a faster recovery to carry out daily activities (Biondi et al., 2013; Grosso et al., 2012; Fogli et al., 2002; Cueto et al., 2006; Roviaro et al., 2006; Wullstein et al., 2001). The financial burden and increase the rate of mortality (Frisch et al., 2010; Sebranek et al., 2013).

The health condition of these patients is worsened by hyperglycemia, hypoglycemia and high glycemic fluctuations, which also increase the likelihood of unfavorable surgical outcomes (Kotagal et al., 2015). A considerably worse cumulative post-operative survival rate is observed in patients with initially higher glucose levels. In addition to being a risk factor for post-operative sepsis (Zhang et al., 2014), hyperglycemia is also associated with endothelial dysfunction (Clarke, 1970), inadequate wound healing (Hommel et al., 2017) and cerebral ischemia (Maruyama and Sato, 2017).

Traumatic stress, blood loss during surgery and intraoperative anesthesia increase the blood glucose levels of patients with diabetes (Hommel et al., 2017). Additionally, the release of glucotropic hormones like steroids can increase insulin resistance, worsen glucose metabolism and cause acid-base and water-electrolyte imbalances (Palermo et al., 2016). Stress reactions may also induce complications of diabetes including hyperglycemic hyperosmolar syndrome and ketoacidosis (Wang et al., 2019). Studies have shown that blood glucose control in patients with diabetes may significantly lower the incidence of glucose metabolism disorders and postoperative complications, leading to improved surgical outcomes for major heart surgery (Lee et al., 2014) and orthopedic surgery (Wukich, 2015).

Smoking was associated with a post-operative complication rate of 8.2%. In addition, smoking was shown to slow down the wound healing process in many surgical operations including neurological surgery, otologic surgery and many types of plastic and reconstructive surgeries, where postoperative surgical site complications are already frequent (Sørensen, 2012; Lau et al., 2013; Joy et al., 2018).

According to our findings, blood transfusion was significantly associated with the incidence of complications in both open and laparoscopic procedures ($p<0.05$). Many recent studies have reported that transfusions of blood components in non-life-saving circumstances may increase the risk of negative consequences that outweigh any substantial benefit, particularly in severely sick patients (Curley et al., 2014; Marik and Corwin, 2008). Many of the documented advantages of blood transfusions come from research on trauma, particularly penetrating damage (Perel et al., 2014).

The findings of assessing the value of blood transfusion after penetration trauma are biased in favor of prospective benefits, particularly for patients who need many blood transfusions. This selection bias reduces the perceived benefit of blood transfusions. On the other hand, anemia poses a significant risk for unfavorable results in most surgical operations, particularly in patients who are severely sick (Shander et al., 2011; Hare et al., 2013; Karkouti et al., 2008).

5. CONCLUSIONS

There are multiple factors have been effect on the open approach more than the laparoscopic approach in our study. Furthermore, multicenter studies are needed to assess the factors related to the morbidity of Saudi Arabian patients and their post-operative outcomes, especially with regard to newer minimally invasive surgical procedures.

Authors' Contributions

Ahmed Saggaf and Khalid Alghamdi equally contributed to the conception and design of the research. Salman Alkatheeri and Saud Albishri performed the study protocol and wrote the initial manuscript draft. Ahmed Saggaf and Sarah Qari contributed to the acquisition and analysis of the data. Wisam Jamal conducted the statistical analysis. Sarah Qari provided subsequent revisions to later drafts of the manuscript. All authors critically reviewed the manuscript, agreed to be fully accountable for ensuring the integrity and accuracy of the work and read and approved the final manuscript.

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Ethical approval

The study was approved by the medical ethics committee of King Abdul-Aziz University Hospital, Jeddah, Saudi Arabia. Code: 621-18.

Informed consent

Not applicable.

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This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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