Incidence and Factors Associated With Post-anesthesia Care Unit Complications at St. Paul's Hospital, Ethiopia. Observational Study

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Abstract

Background: Postoperative complications are frequent encounters in the patients admitted to post-anesthesia care units (PACU). The main aim of this study was to assess the incidence and associated factors of complications among surgical patients admitted to PACU.

Methods: This is an observational study of 396 surgical patients admitted to PACU. This study was conducted from February 1 to March 30, 2021, in Ethiopia. Study participant's demographics, anesthesia, and surgery-related parameters, PACU complications, and length of stay in PACU were documented. Multivariate and bivariate logistic regression analyses, the odds ratio (OR), and 95% confidence interval (CI) were calculated. P-value < 0.05 was considered as statistically significant.

Results: The incidence of complications among surgical patients admitted to PACU was 54.8%. Of these, respiratory-related complications and postoperative nausea/vomiting were the most common types of PACU complications. Being a female (AOR=2.928;95%CI:(1.899-4.512)) was significantly associated with an increased risk of developing PACU complications. Duration of anesthesia >4 hours (AOR=5.406; 95% CI (2.418_12.088) revealed an increased risk of association with PACU complications. The occurrences of intraoperative complications (AOR=2.238; 95% CI (0.991_5.056) during surgery were also associated with PACU complications. Patients who develop PACU complications were strongly associated with length of PACU stay for > 4 hours (AOR=2.177; 95% CI (0.741_6.401)).

Conclusion: The identified risk factors for complications in surgical patients admitted to PACU are female sex, longer duration of anesthesia, and intraoperative complications occurrences. Patients who developed complications had a long time of stay in PACU.

Introduction

Post-operative complications in patients admitted to post-anesthesia care units (PACU) are frequent encounters and approximately account for 4.25% - 37.3%, with severity ranging from trivial to critical incidents (1-5).

Complications types may differ in literature for various reasons: however, the most frequently encountered PACU complications were respiratory, cardiovascular, hypothermia, pain, postoperative nausea and vomiting (PONV), and central nervous system-related adverse events (6-13).

According to the review reports of Anesthesia Closed Claims Project (CCP) database, the leading causes of anesthesia related malpractice claims is the breakdown in communication (14).

The operating room (OR), the post-anesthesia care unit (PACU), and the intensive care unit (ICU) are particularly vulnerable to communication failures between clinicians.

Ineffective communication in the PACU affects health-care expenses, length of hospital stays, unplanned ICU admission, mortality, and morbidity (15-17).

The dearth of Interventional studies revealed that the implementation of a checklist decreased the overall medical errors and rate of preventable adverse events in PACU (18-20). Other study also showed that using the post-anesthetic care tool (PACT) improves early detection of patients at risk of deterioration, handover to surgical ward nurses, and reduces health care expenses (21).

Therefore, prevention and management strategies based on implementing standardized handover protocols, proper staffing of well-trained experts, monitoring devices, and infrastructures to improve the quality of patient care should be a crucial part of safe anesthesia in PACU.

In previously published studies, patient, anesthesia, and surgery-related risk factors have been identified for PACU complications. Further explorations into the etiology of these complications should help develop strategies to prevent and manage those critical incidents.

In a four-centered study done in Canada, ASA physical status, length of anesthesia duration, occurrence of intraoperative complications, and use of pure spinal or narcotic techniques have been identified as independent single risk factors for PACU complications (10).

On the other hand, the study done in the Philippines revealed that duration of surgery, the occurrence of intraoperative complications, and postoperative complications were identified as significant predictors for the length of stay at PACU (22).

Despite the magnitude of the problem in daily clinical activity, there has been very little or no research examined the incidence and factors associated with PACU complications in sub-Saharan countries including Ethiopia. The main objective of this study is to evaluate the incidence and factors associated with postoperative complications in PACU.

Materials And Methods

Study design, settings and patients

A hospital based observational study was employed from February 01 to May 30, 2021, in St. Paul's millennium medical college and teaching hospital, Ethiopia.

This study was reported in line with STROCSS criteria and registered at www.researchregistry.com with research registry UIN: research registry 7482.

The study was approved by the St. Paul's hospital ethical clearance committee and informed written consent was obtained from each study participant and/or legal guardians of underage study participants. Confidentiality was assured throughout the research.

Inclusion criteria

During the study period, we included all surgical patients who were admitted to PACU for monitoring and stabilization into this study.

Exclusion criteria

Patients transferred directly from the operation theater to an intensive care unit, ward, or outpatient department were excluded.

Postoperative and Post-anesthesia care

On the arrival of patients from OR to the PACU, the responsible nurses applied the standard monitoring.

Nurses are available at all times, and anesthetists/anesthesiologist supervise the overall activities based on patients' conditions.

In the institution, there is a lack of uniform and standardized checklist used for discharging the patients from one department to others; however, each patient admitted to PACU were monitored for a minimum of 1 to 4 hours, and discharged to the respective wards/units.

Sample size and sampling techniques

We calculated the sample size from the primary outcome variable by using single population formula, which is the incidence of PACU complications. Since there is no preliminary data in the study setting $P=0.5$ (prevalence of PACU complications 50%) was taken for the calculation to get the largest sample size, 95% confidence interval, and 5% margin of error gives us 384 study subjects. Since the studied population in a year is less than 10,000, the corrected sample size formula was used, and the final sample size becomes 396 by adding a 10% attrition rate. A convenient sampling technique was used to select the study participants.

Data collection techniques

We collected our data using pretested questioner by trained 4 PACU nurses and anesthetists data collectors. Demographics and preexisting co-morbidity variables were documented from patient medical chart. The occurrences of complications and length of PACU stay was recorded from bedside observation, monitoring devices, and documentation of attending nurses until discharging patients to the respective department. The principal investigator cross-checked the collected data to ensure accuracy and completeness.

Data analysis

We entered and analyzed data using Statistical Package for Social Sciences (SPSS version 26). We used descriptive statistics to summarize the frequency table, and the standardized residual tests to test the outlier data. Multi-collinearity was checked by VIF, tolerance, and confidence index. All independent variables were analyzed using bivariate analysis, and the variables that had an association at a p-value less than or equal to 0.25 were entered into a multivariable logistic regression model, and $P\text{-value} < 0.05$ was considered to be risk factors for PACU complications during the postoperative period in this study. The results of associated variables were presented as frequency table, crude, and adjusted odds ratio

with 95% confidence interval. Hosmer Lemeshow test was used to check the goodness of the model, and the model was the best fit with a P-Value of 0.689.

Operational definitions

Respiratory-related complications: Patients who develop Desaturation, Stridor, and wheezing.

Desaturation: Oxygen saturation < 94% checked by pulse oximetry.

Stridor: High-pitched sound during inspiration.

Cardiovascular-related complications: Patients who develop hypotension, hypertension, bradycardia, tachycardia, and shock.

Hypotension: A decrease of the systolic BP by 20% from baseline

Hypertension: An increase in systolic BP by 20% from baseline

Shock: Hypotension with signs of poor peripheral perfusion

Tachycardia: Heart rate >100 for adults, different in different pediatric age groups

Bradycardia: Heart rate < 60 for adults and less than 80 for children

Central nervous system complications: Patients who experience deep sedation, seizure, and confusion.

Other complications: patients who experience pain, hypothermia, bleeding from the incision site, and unplanned ICU admission.

PACU complications: occurrence of one or more of the above in the PACU.

Results

Demographics and preexisting co-morbidity characteristics of the study participants.

A total of 396 patients admitted to PACU during the study period were enrolled for final analysis. Of these, 204(51.51%) were males and females accounted for 192 (48.49%). The mean (SD) of the study participants was 38.99(19.47) with a range of 4 months - 96 years. Regarding the ASA physical status, the majority 305(77.02%) of patients were ASA class I followed by ASA class II 69 (17.42%) and $\geq$ ASA class III 22 (5.56%). Assessment of preoperative co-morbidity revealed that only 94(23.74%) of patients had preexisting co-morbidity as shown in (Table 1).

Table 1: Demographic characteristics of study participants.

Variables	Category	Number	Percent
Sex	Male	204	51.51
	Female	196	48.49
Age group	≤ 5	36	9.1
	6 - 15	15	3.8
	16 - 29	101	25.5
	30 - 45	79	19.95
	46 - 60	127	32.05
	> 60	38	9.6
ASA classification	1	305	77.02
	2	69	17.42
	≥3	22	5.56
Preexisting co-morbidity	None	302	76.26
	Respiratory	9	2.27
	CVS	22	5.55
	Neurological	3	0.76
	Endocrine (DM)	17	4.3
	RVI	24	6.06
	> 1 Co-morbidity	19	4.8

Anesthesia-related characteristics of study participants.

Of all study participants, 296 (74.75%) had received general anesthesia. With regards to the level of anesthesia care providers, most 246(62.12%) of the procedures have been performed by residents and anesthesiologists 150(37.88%). Cases with intraoperative complications were observed only in 35 (8.34%) patients. The mean (SD) duration of anesthesia and duration of stay in the PACU was 157.88 (86.87) and 170.74(38.49) respectively (Table 2).

Table 2: Anesthesia-related characteristics of study participants.

Types of anesthesia	General	296	74.75
	Regional	60	15.15
	Combined	24	6.06
	MAC	16	4.04
Level of anesthetist	Anesthetist	150	37.88
	Resident	246	62.12
Anesthesia duration (hours)	0 - 2 hours	172	43.43
	2 - 3 hours	106	26.77
	3 - 4 hours	77	19.45
	> 4 hours	41	10.35
Intraoperative complication presence	Yes	35	8.84
	No	361	91.16
Duration of stay in the PACU	60-120 min	172	43.43
	120-180 min	106	26.77
	180-240 min	77	19.45
	> 240 min	41	10.35

Surgery-related characteristics of study participants.

The majority of 298(75.25%) types of surgery were elective, and the rest 98(24.75) were emergency. Regards to surgical indication by specialty, most of them were general surgery 147(37.12%), gynecology 44(11.12%), orthopedics 43(10.86%), and variety of pediatrics surgery 41(10.35%). The majority of the surgical procedures have been done in supine position 359 (90.66%). More than two-thirds 304 (76.76%) of surgical duration were between 0- 3 hours (Table 3).

Table 3: Surgery-related characteristics of the study participants.

Variables	Category	Frequency	Percent
Types of surgery	Elective	298	75.25
	Emergency	98	24.75
Surgical indication by specialty	General Surgery	147	37.12
	Gynecology	44	11.12
	Orthopedics	43	10.86
	Pediatric surgery	41	10.35
	Cardiothoracic	15	3.78
	Hepatobiliary	17	4.3
	Urosurgery	32	8.08
	Neurosurgery	29	7.32
	ENT	28	7.07
Position during surgery	Supine	359	90.66
	Prone	13	3.28
	Lateral	11	2.78
	Lithotomy	13	3.28
Surgical time (hours)	0 - 2 hours	144	36.36
	2 - 3 hours	160	40.4
	3 - 4 hours	60	15.15
	> 4 hours	32	8.09

Incidence of PACU complications.

From the total study participants admitted to PACU, the incidence of PACU complications was 217 (54.8%) Figure 1.

Types of PACU complications

With regards to the types of PACU complications, the majority of patients were developed respiratory and airway related adverse events 94 (43.32%) followed by postoperative nausea and vomiting (PONV) 48(22.12%), and Cardiovascular related adverse events 41 (18.9%) as shown in (Table 4).

Table 4: Types of PACU complications of study participants.

Types of Complications	Frequency	Percent
Airway & Respiratory	94	43.32
CVS	41	18.9
PONV	48	22.12
CNS	19	8.76
Other Complications	15	6.9

Patient, anesthesia, and surgery-related factors associated with PACU complications among study participants.

The results from multiple logistic regressions showed that female sex, prolonged duration of anesthesia, intraoperative complications presence, and length of stay in PACU were found to be statistically significant with PACU complications.

Female sex (AOR=2.570;95%CI:(1.621 - 4.075)), duration of anesthesia greater than 4 hours (AOR=5.406; 95% CI (2.418_12.088)), intraoperative complications occurrences (AOR=2.238; 95% CI (0.991_5.056) and duration of PACU stay > hours 4.538 (2.089 - 9.857) had shown an association with postoperative complications in PACU (Table 5).

Table 5: Multivariate logistic regression analysis showing factors associated with PACU complications.

Variables	Category	PACU complication		COR 95% CI	AOR 95% CI	P-value
		No	Yes			
Sex	Male	117	87	1	1	<.0001
	Female	62	130	2.820(1.870-4.251)	2.570 (1.621 - 4.075) ***	
Duration of anesthesia hours	0 - 2	101	69	1	1	0.002
	2 - 3	42	66	2.3 (1.404 - 3.767)	2.226 (1.330_3.725) **	
	3 - 4	26	51	2.871 (1.635 - 5.041)	3.050 (1.690 _ 5.505) ***	
	> 4	10	31	4.508 (2.089 - 9.857)	5.406(2.418_12.088) ***	
Intraoperative complication	No	9	26	1	1	0.025
	Yes	170	191	2.571 (1.172- 5.641)	2.238 (0.991_5.056) **	
Duration of PACU stay hours	1 -2	12	6	1	1	0.242
	2 - 3	80	74	2.300 (1.404 - 3.767)	1.226 (0 .426_3.527)	
	3 - 4	44	62	2.871(1.635-5.041)	1.898 (0 .645_5.584)	
	> 4	43	75	4.538 (2.089 - 9.857)	2.177 (0 .741_6.401) **	

Statistically significant **P < 0.05, ***P<0.001, AOR adjusted odds ratio.

Discussion

Our study has study revealed that the overall incidence of postoperative complications in PACU among patients undergoing surgery is 54.6%. Previous studies have been investigated the incidence of complications in PACU in different countries reported that only (4.25% - 37.3%) of surgical patients develop PACU complications (1-4).

The low ratio of a trained nurse on PACU compared to work overload intensity (2), and the unstructured and inconsistent handover protocol (16) in the clinical setup could explain the increased rate of complications. In addition, number of sample sizes, operational definitions, and study design differences might also contribute to the incidence rate.

Of all PACU complications, the majority (17.7%) were respiratory and airway related, which is consistent with previous studies. (5-7). The possible explanation related to respiratory complications is due to hypoventilation caused by hypo-active emergence and residual effects of muscle relaxant agents, as most of the participants had undergone surgery with general anesthesia. (4, 23)

In contradiction to our finding, other studies (8,9) reported that the majority of PACU complications were cardiovascular-related. In another study, PONV (10.,23), central nervous system (2, 11), and pain (12,13) were reported as the most common PACU complications.

Our study found that female sex, duration of anesthesia, presence of intraoperative complications, and duration of stay in PACU were factors associated with PACU complications.

Female patients were more at risk of developing complications than male counterparts (AOR=2.570;95%CI:(1.621 - 4.075)). Similarly, other studies (12, 25-27) also found being a female is a risk factor to develop PACU complications. The reason might be (22.12%) incidence of PONV occurred in our study is higher in females, which contributes to the rate of PACU complications. In addition, gynecological procedures are a risk factor to develop PONV, which is confined in female patients.

Another factor associated with PACU complications in the present study was the duration of anesthesia. Duration of anesthesia > 4 hours (AOR=5.406; 95% CI (2.418_12.088) and 2 - 3 hours (AOR=3.050 (1.690 - 5.505) had five- and three-folds risk for developing PACU complications compared to the duration of anesthesia less than or equal to 2 hours respectively. This result is consistent with other studies (6,10, 25,28) that reported the risk of developing PACU complications is higher in patients with prolonged duration of anesthesia.

The intraoperative complications presence (AOR=2.238; 95% CI (0.991_5.056) were a risk factor to predict PACU complications, as revealed by the present study (6,7,10).

Inconsistent with our findings, other studies revealed that types of anesthesia, the urgency of surgery, ASA class, preexisting disease, and other factors are associated with PACU complications. The standard of clinical setup, types of surgery performed, level of expertise, available medications, sustainable training, and attention given to the health sector might contribute to the dissimilarity of the findings.

The length of stay in PACU greater than 4 hours (AOR=4.538;95% CI (2.089 - 9.857) were strongly correlated with the incidence of PACU complication, our study also observed that patients who encountered PACU complications significantly required a prolonged duration of stay than initially planned compared to patients without complications (9, 22).

The limitation of the study

This study was conducted in a single-center hospital which is difficult to conclude the overall features in the country. Secondly, this study identified complications that exclusively occurred in PACU and failed to detect any types of complications experienced by patients after discharged from PACU.

Strength of the study

This study is a prospective and observational study used a primary source of data.

Conclusion

The incidence of PACU complications is 54.6% in the present study which is higher than prior studies done in different countries. Female sex, intraoperative complications occurrence, and duration of anesthesia are found to be independent risk factors for developing PACU complications.

Based on the findings of the present study, we recommend the PACU team need to develop risk predicting tools to improve the quality of care and patient outcomes.

Abbreviations

GA: general anesthesia, PACU: post-anesthesia care unit, PONV: post-operative nausea and vomiting, OR: operation room, ICU: intensive care unit

Declarations

Acknowledgments

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Authors' contributions

BA design the methodology and coded data. DZ performed data analysis and draft the manuscript. All authors read and approved the final manuscript.

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This study did not receive funding.

Availability of data and materials

The dataset during and/or analyzed during the current study available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Ethical clearance was obtained from research committee at St. Paul's hospital millennium medical college and informed written consent was received from each study participants.

Consent for publication

Not applicable

Competing interest

The authors declare that they have no competing interests.

References

1. Faraj JH, Vegesna AR, Mudali IN, Khairay MA, Nissar S, Alfarhan M, Sabir K, El-Imam F, Anto L, Go T. Survey and management of anaesthesia related complications in PACU. *Qatar medical journal*. 2013 Nov 1;2012(2):15.
2. Zelcer J, Wells DG. Anaesthetic-related recovery room complications. *Anaesthesia and intensive care*. 1987 May;15(2):168-74.
3. Belcher AW, Leung S, Cohen B, Yang D, Mascha EJ, Turan A, Saager L, Ruetzler K. Incidence of complications in the post-anesthesia care unit and associated healthcare utilization in patients undergoing non-cardiac surgery requiring neuromuscular blockade 2005–2013: a single center study. *Journal of clinical anesthesia*. 2017 Dec 1; 43:33-8.
4. Kluger MT, Bullock MF. Recovery room incidents: a review of 419 reports from the Anaesthetic Incident Monitoring Study (AIMS). *Anaesthesia*. 2002 Nov;57(11):1060-6.
5. Van der Walt JH, Webb RK, Osborne GA, Morgan C, Mackay P: The Australian incident monitoring study. Recovery room incidents in the first 2000 incident reports. *Anaesth Intensive Care*, Oct; 21(5):650-652. 1993.
6. Tarrac SE. A description of intraoperative and postanesthesia complication rates. *Journal of perianesthesia Nursing*. 2006 Apr 1;21(2):88-96.
7. M Salman J, N Asfarn S. Recovery Room Incidents. *Basrah Journal of Surgery*. 2007 Jun 28;13(1):1-5.
8. Hajnour MS, Tan PS, Eldawlatly A, Alzahrani TA, Ahmed AE, Khokhar RS. Adverse events survey in the postanesthetic care unit in a teaching hospital. *Saudi Journal of Laparoscopy*. 2016 Jan 1;1(1):13.
9. Bruins SD, Leong PM, Ng SY. Retrospective review of critical incidents in the post-anesthesia care unit at a major tertiary hospital. *Singapore medical journal*. 2017 Aug;58(8):497.
10. Duncan PG, Cohen MM, Tweed WA, Biehl D, Pope WD, Merchant RN, DeBoer D. The Canadian four-center study of anaesthetic outcomes: III. Are anaesthetic complications predictable in day surgical practice? *Canadian Journal of anaesthesia*. 1992 May;39(5):440-8.
11. Nourizadeh M, Rostami M, Saeedi F, Niknejad H, Tatari M. Evaluation of the Incidence of Post-anesthetic Complications in Recovery Unit of 9-day Hospital in Torbat-e-Heydaryieh in 2016. *Modern Care Journal*. 2018 Apr 30;15(2).

12. Poorsheykhian M, Emami Sigaroodi A, Kazamnejad E, Raoof M. Incidence of post general anesthesia complications in recovery room. *Journal of Guilan University of Medical Sciences*. 2012 Jul 10;21(82):8-14.
13. Popov DC, Peniche AD. Nurse interventions and the complications in the post-anesthesia recovery room. *Revista da Escola de Enfermagem da USP*. 2009; 43:953-61.
14. Douglas RN, Stephens LS, Posner KL, Davies JM, Mincer SL, Burden AR, Domino KB. Communication failures contributing to patient injury in anaesthesia malpractice claims. *British Journal of Anaesthesia*. 2021 Sep 1;127(3):470-8.
15. Eichenberger AS, Haller G, Cheseaux N, Lechappe V, Garnerin P, Walder B. A clinical pathway in a post-anesthesia care unit to reduce length of stay, mortality, and unplanned intensive care unit admission. *European Journal of Anaesthesiology (EJA)*. 2011 Dec 1;28(12):859-66.
16. Nagpal K, Arora S, Abboudi M, Vats A, Wong HW, Manchanda C, Vincent C, Moorthy K. Postoperative handover: problems, pitfalls, and prevention of error. *Annals of surgery*. 2010 Jul 1;252(1):171-6.
17. Yang CC, Chuang YF, Chen PE, Tao P, Tung TH, Chien CW. Effect of Postoperative Adverse Events on Hospitalization Expenditures and Length of Stay Among Surgery Patients in Taiwan: A Nationwide Population-Based Case-Control Study. *Frontiers in medicine*. 2021 Feb 10; 8:82.
18. Bigham MT, Logsdon TR, Manicone PE, Landrigan CP, Hayes LW, Randall KH, Grover P, Collins SB, Ramirez DE, O'Guin CD, Williams CI. Decreasing handoff-related care failures in children's hospitals. *Pediatrics*. 2014 Aug 1;134(2): e572-9.
19. Starmer AJ, O'Toole JK, Rosenbluth G, Calaman S, Balmer D, West DC, Bale Jr JF, Clifton EY, Noble EL, Lisa LT, Srivastava R. Development, implementation, and dissemination of the I-PASS handoff curriculum: a multisite educational intervention to improve patient handoffs. *Academic Medicine*. 2014 Jun 1;89(6):876-84.
20. Boat AC, Spaeth JP. Handoff checklists improve the reliability of patient handoffs in the operating room and postanesthesia care unit. *Pediatric Anesthesia*. 2013 Jul;23(7):647-54.
21. Street M, Phillips NM, Kent B, Colgan S, Mohebbi M. Minimising post-operative risk using a Post-Anaesthetic Care Tool (PACT): protocol for a prospective observational study and cost-effectiveness analysis. *BMJ Open*. 2015 May 1;5(6): e007200.
22. Aspi MT, Ko-Villa E. The Use of Determinants of Length of Stay in the Post-anesthesia Care Unit (PACU) at the Philippine General Hospital among Postoperative Patients who Underwent Elective Surgeries to Create a Predictive Model for PACU Length of Stay. *Acta Medica Philippina*. 2020 Oct 28;54(5).
23. Xará D, Santos A, Abelha F. Adverse respiratory events in a post-anesthesia care unit. *Archivos de Bronconeumología (English Edition)*. 2015 Feb 1;51(2):69-75.
24. Manninen PH, Raman SK, Boyle K, El-Beheiry H. Early postoperative complications following neurosurgical procedures. *Canadian Journal of Anesthesia*. 1999 Jan 1;46(1):7.
25. Quintero-Cifuentes IF, Pérez-López D, Victoria-Cuellar DF, Satizábal-Padridín N, Billefals-Vallejo ES, Castaño-Ramírez DA, Beltrán-Osorio LD. Incidence of early postanesthetic hypoxemia in the

postanesthetic care unit and related factors. Colombian Journal of Anesthesiology. 2018 Dec;46(4):309-16.

26. Tennant I, Augier R, Crawford-Sykes A, Ferron-Boothe D, Meeks-Aitken N, Jones K, Gordon-Strachan G, Harding-Goldson H. Minor postoperative complications related to anesthesia in elective gynecological and orthopedic surgical patients at a teaching hospital in Kingston, Jamaica. Revista brasileira de anestesiologia. 2012; 62:193-8.
27. Myles PS, Hunt JO, Moloney JT. Postoperative 'minor complications: comparison between men and women. Anaesthesia. 1997 Apr;52(4):300-6.
28. Phan K, Kim JS, Kim JH, Somani S, Di'Capua J, Dowdell JE, Cho SK. Anesthesia duration as an independent risk factor for early postoperative complications in adults undergoing elective ACDF. Global spine journal. 2017 Dec;7(8):727-34.

Figures

Figure 1

Incidence of PACU complications.