Perioperative Risk Factors for Determining the Unplanned Admission to ICU after Surgery

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Introduction

Many ICU admissions occur after surgery and anesthesia, yet not all postoperative ICU admissions are planned or anticipated prior to the scheduled case. Unplanned admission to ICU (UIA) has been used as a surrogate marker of perioperative patient safety and adverse events. UIA has been shown to have a negative impact on patient safety, such as increased mortality and longer hospital stay in previous studies. Also it could contribute to increased medical expenses.

The objective of this study was to compare the characteristics of UIA and planned ICU admission, and to identify perioperative risk factors that may lead to UIA.

Materials & Methods

After approval of the Institutional Review Board (SGPAIK2016-09-014), we reviewed the electronic medical records of adult patients (≥ 20 years) who have undergone an elective operation from January 1, 2015 to December 31, 2016 and who have been in the intensive care unit within 24 hours.

#Exclusion criteria: Emergency cases & Surgery, which usually involves ICU after surgery (cardiac, Whipple’s, neurosurgery, lung resection surgery)

Patient demographics, ASA physical status, preoperative comorbidities, type and duration of anesthesia and surgery, length of hospital and ICU stay, intraoperative adverse events, transfusion, perioperative laboratory results, mortality, social history (smoking/alcohol/drug) and APACHE score were recorded.

In order to identify significant independent predictors of unplanned admission to ICU, univariate (cutoff value was P<0.2) and multivariate logistic regression analyses were used.

For the univariate analysis, patient demographics, ASA physical status, preoperative comorbidities (cardiac, respiratory, hepatic, renal, neurology and endocrinology), type and duration of anesthesia and surgery, whether important intraoperative events occurred, transfusion and perioperative laboratory results were evaluated by t-test, chi-square or Fisher’s exact test.

Results

Criteria of the Priority in admission to ICU	Unplanned (N=97)	Planned (N=45)
▪ Patients in need of intensive care and monitoring that cannot be done in places other than ICU	27 (28.4%)	10 (22.2%)
▪ Postoperative patients with respiratory failure, shock or cardiovascular instability requiring invasive monitoring, ventilator care or continuous administration of vasoactive drugs	25 (26.3%)	5 (11.1%)
▪ Patients who is in need of active monitoring to be provided with immediate treatment at any time	40 (42.1%)	29 (64.4%)
▪ Patients requiring limited range of treatment (eg, Those who want temporary treatment except for intubation, mechanical ventilation, CPR)	3 (3.2%)	1 (2.2%)

Intraoperative events	Unplanned (N=97)	Planned (N=45)
Uncontrolled hypotension	26 (27%)	7 (16%)
Sudden onset of cardiac dysrhythmia	1 (1%)	1 (2%)
Acute MI during procedure	1 (1%)	1 (2%)
Accidental upper airway obstruction	1 (1%)	1 (2%)
Cardiac arrest	3 (3%)	3 (7%)
Decrease of body temperature below 35°C	2 (2%)	0 (1%)
Unclassified	0 (0%)	1 (2%)
None of intraoperative event	63 (65%)	36 (80%)

Conclusions

Unplanned admission to the ICU after elective surgery is not a rare event. Although we did not show statistical significance through this study, it seems to be related to negative postoperative outcomes (higher mortality and prolonged hospital stay, etc). We estimate that adequate management of preoperative anemia and intraoperative hypotension might be helpful in reducing the UIA after surgery. Clinicians should be more interested in control of the perioperative risk factors that affect unplanned ICU admissions. Also prospective studies on these risk factors are needed to establish a threshold for planned ICU admission.

		unplanned (n=97)	planned (n=45)	P value
Sex	Female	46 (47.4%)	18 (40.0%)	0.518
	Male	51 (52.6%)	27 (60.0%)	
Age (years)		71.2 ± 14.1	67.4 ± 16.0	0.151
	20 ~ 65 yrs	26 (26.8%)	21 (46.7%)	
	65 ~ 90 yrs	65 (67.0%)	23 (51.1%)	
	> 90 yrs	6 (6.2%)	1 (2.2%)	
Height (cm)		159.2 ± 17.5	162.1 ± 10.4	0.223
Weight (kg)		59.5 ± 12.6	60.2 ± 11.4	0.764
Obesity (BMI≥30)	Yes	7 (7.2%)	0 (0.0%)	0.152
	No	90 (92.8%)	45 (100.0%)	
Hospital stay (days)		39.2 ± 32.2	33.6 ± 26.6	0.307
Long hospital stay (over 30 days)	Yes	45 (46.4%)	16 (35.6%)	0.302
	No	52 (53.6%)	29 (64.4%)	
Mortality		10 (10.3%)	3 (6.7%)	0.698
ASA PS class	II	37 (38.1%)	18 (40.0%)	0.886
	III	57 (58.8%)	25 (55.6%)	
	IV	3 (3.1%)	2 (4.4%)	
Anesthesia time (min)		296.4 ± 196.5	353.6 ± 197.4	0.110
Surgical time (min)		232.2 ± 191.7	291.4 ± 189.8	0.088
ICU stay (days)		3 (2, 4)	2 (2, 3)	0.230
	>3 days	29 (29.9%)	7 (15.6%)	0.105
	≤3 days	68 (70.1%)	38 (84.4%)	
APACHE II score		27 (23.0, 31.5)	26 (23.0, 29.0)	0.415
PACU stay before ICU	Yes	29 (29.9%)	2 (4.4%)	0.001
	No	68 (70.1%)	43 (95.6%)	
Duration of PACU stay (min)		81 (50, 106)	73 (36, 110)	0.904
Apply ventilator at ICU	Yes	24 (24.7%)	8 (17.8%)	0.479
	No	73 (75.3%)	37 (82.2%)	
Continued infusion of cardiovascular drug at ICU	Yes	28 (28.9%)	8 (17.8%)	0.228
	No	69 (71.1%)	37 (82.2%)	

Surgical Procedures	Unplanned	Planned
Plastic procedures	3%	0%
Procedures on nervous system	1%	0%
Procedures on cardiovascular system	1%	2%
Procedures on respiratory system	2%	2%
Procedures on blood and blood-forming organs	1%	0%
Procedures on digestive system#1	18%	49%
Procedures on musculoskeletal system#2	55%	27%
Procedures on ear, nose, mouth, and pharynx	4%	2%
Procedures on urinary system and male genital organs	10%	7%
Procedures on female genital organs and breast	5%	7%
Procedures on eye and adnexa	0%	4%

Comparison between groups: #1; P=0.0002, #2; P=0.0021

	Estimate	Std. Error	z value	Pr(> z)	OR	95% lcl	95% ucl
(Intercept)	-0.5444	3.3716	-0.16	0.8717	0.58	0.00	278.04
age (years)	0.0013	0.0164	0.08	0.9352	1.00	0.97	1.03
height (cm)	0.0071	0.0163	0.43	0.6647	1.01	0.98	1.05
weight (kg)	-0.0078	0.0181	-0.43	0.6663	0.99	0.96	1.03
type of surgery	0.0907	0.1230	0.74	0.4606	1.09	0.87	1.41
preoperative Hb (g/dl)	-0.2776	0.1181	-2.35	0.0187	0.76	0.60	0.95
postoperative Hb (g/dl)	0.1707	0.1489	1.15	0.2517	1.19	0.89	1.60
duration of anestheis (min)	-0.0084	0.0086	-0.98	0.3282	0.99	0.97	1.01
duration of surgery (min)	0.0100	0.0088	1.13	0.2564	1.01	0.99	1.03
preop. cardiac disease	-0.5192	0.4832	-1.07	0.2826	0.59	0.23	1.55
History of alcohol	0.9579	0.4935	1.94	0.0522	2.61	1.00	6.99