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CORRELATION BETWEEN OXYGEN SATURATION AND LENGTH OF STAY IN SURGICAL ICU

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ABSTRACT This pilot study aimed at studying the correlation between oxygen saturation (SpO2) and length of stay (LOS) in Intensive Care Unit (ICU) of 60 consecutive patients who underwent a major surgery. An immediate SpO2 recording was noted upon arrival in the ICU and, thereafter, every six hourly till the patient was transferred out. LOS was noted in terms of days spent in ICU. The correlation between SpO2 levels and LOS was calculated using Pearson's correlation coefficient r. A regression analysis method was used for testing the effect of SpO2 over time. Minimal SpO2 measured immediately postoperatively was 95% and the maximum was 100% with a mean of 98.57% (standard deviation 1.345). The LOS varied one day to ten days with a mean of 2.24 days (standard deviation 1.967). A strong correlation was found between SpO2 in patients and LOS in surgical ICU for postoperative patients making pulse oximetry very relevant.

KEYWORDS : SpO2, Surgical ICU, LOS

Introduction

Tissue hypoxia is a key trigger of complications leading to organ dysfunction and failure. It occurs due to tissue hypoperfusion resulting from an imbalance between oxygen demand and delivery. This scenario is common in the postoperative phase especially after major surgeries and results in increased utilization of resources and cost of care in the hospital (1). Tissue hypoxia may have its origins in impaired oxygenation, oxygen delivery, hemoglobin concentration or abnormal hemoglobin performance. After major surgeries, there are chances of patients experiencing prolonged ICU (intensive care unit) length of stay (LOS) as a result of these deranged dynamics.

One of the commonest modalities for detecting tissue hypoperfus ion is by quantifying the oxygen saturation (SpO2) of blood by the use of a pulse oximeter. Pulse oximetry improves patient safety through the detection of clinically inapparent episodes of desaturation and can allow a reduction in adverse events for the patient (2). In general low blood oxygen saturation is classically associated with high morbidity and mortality. SpO2 monitoring is also one of the vital parameters to prevent adverse outcomes of ICU admission (3). It is a key step in detecting early tissue hypoxia and intervening accordingly. Further, use of pulse oximetry in ICUs results in reduction of arterial blood gas usage and hence significant cost cutting, and improved care (4). Not many studies have been done on outcomes depicted by LOS in ICU by focusing on pulse oximetry in adult postoperative patients. This study attempts to study the correlation between oxygen saturation and LOS in surgical ICU patients following major surgeries.

Materials and Methods

This was a pilot study, conducted over a one month period, from August to September 2016 in a tertiary care teaching hospital. All patients received general anaesthesia for their respective surgeries but were fully reversed from the effects of anaesthesia at the end of surgery before being shifted to the surgical ICU for postoperative monitoring. The inclusion criteria included ages between 18 to 70 years, both male and female patients, and major surgeries lasting for three hours or more. The exclusion criteria were any patients requiring postoperative ventilator support and all patients with any pre-existing respiratory pathology like Chronic Obstructive Pulmonary Disease, Bronchial Asthma or lung malignancy. An informed consent was taken before the start of the study from all patients.

An immediate SpO2 recording was taken upon arrival in the ICU and the mode of postoperative oxygen, if at all being delivered, whether by face mask or nasal prongs or simply on room air, was noted. Thereafter, six hourly SpO2 recordings were noted till the time the patient was transferred out from the ICU. The length of stay was noted in terms of number of days spent in ICU postoperatively. A stay of more than 12 hours on any given day was denoted as one full day. The basic requirement at the time of being transferred out from ICU was that the patient should have been on room air (free of supplementary oxygen) for atleast six hours without the oxygen saturation going below 94%.

Statistical Analysis

The correlation between SpO2 levels and length of stay was calculated using Pearson's correlation coefficient r. When SpO2 observations were done after every 6 hours and effect of SpO2 was tested over time (length of stay) a regression analysis method was used.

Results

A total of 60 postoperative surgical patients were studied. The details of age, sex, surgery done, SpO2 recorded immediately postoperatively and the mode of oxygen delivered are given in Table 1.

Table 1. Patient and surgery details

S No.	Age (yrs)	Sex (M/F)	Type of Surgery	Immediate post-operative SpO2 level	Mode of O2 delivery	Length of Stay (LOS) in Days	Outcome (Transferred /Death)
1	28	F	Nephrectomy Right (Non Functional Kidney)	98%	Face mask @5L/min	02	Transferred
2	56	F	C1 C2 posterior Sublaminal wiring (Cervical Trauma)	100%	Face mask @5L/min	01	Transferred
3	37	F	Staging laparotomy (Bilateral adnexal mass)	99%	nasal prongs @2L/min	02	Transferred
4	37	F	Lap sleeve gastrectomy (Morbid Obesity)	98%	Face mask @5L/min	02	Transferred

5	55	F	Laparoscopic Cholecystectomy (Cholelithiasis)	99%	Face mask @5L/min	01	Transferred
6	36	M	Left sub temporal craniotomy (Head Injury with SDH	100%	Face mask @5L/min	02	Transferred
7	60	M	Laminectomy L4-L5 (PIVD L4-L5)	100%	Face mask @5L/min	01	Transferred
8	50	F	Inguinal Hernia Reduction + Mesh repair	98%	Face mask @5L/min	01	Transferred
9	25	F	Laparoscopic Splenectomy (Idiopathic Thrombocytopenic Purpura)	99%	Face mask @5L/min	01	Transferred
10	68	F	Trans-thoraccic Esophagectomy (Esophageal Stricture)	100%	Face mask @5L/min	01	Transferred
11	28	M	Open Reduction and Internal Fixation (ORIF) Calcaneum (Fracture Calcaneum)	100%	Room Air	05	Transferred
12	47	F	Lap Vaginal Hysterectomy (Uterine Prolapse)	100%	Room Air	0.5	Transferred
13	51	M	Adrenalectomy Right (Adrenal Mass)	100%	Face mask @4L/min	01	Transferred
14	25	F	Laparoscopic Sleeve Gastrectomy (Morbid Obesity)	100%	Face mask @6L/min	01	Transferred
15	50	F	Left Hepatectomy (Hepatic Space Occupying Lesion)	100%	Face mask @5L/min	01	Transferred
16	18	M	Splenectomy (Heriditary Spherocytosis)	100%	Room Air	01	Transferred
17	21	F	Craniotomy + excision (Intracranial Space Occupying Lesion)	100%	Room Air	03	Transferred
18	65	M	Wound closure (Burst abdomen)	100%	Face mask @5L/min	03	Transferred
19	70	M	Radical Nephrectomy Right (Renal Cell Carcinoma)	100%	Face mask @5L/min	01	Transferred
20	55	M	Debridement diabetic foot left	99%	Room Air	01	Transferred
21	65	F	Laparoscopic Sleeve Gastrectomy (Obesity)	100%	Face mask @5L/min	02	Transferred
22	41	M	Laryngectomy (Ca Larynx)	100%	Face mask @5L/min	01	Transferred
23	64	M	Laparoscopic Right Hemicolectomy (Ca Colon)	99%	Face mask @5L/min	01	Transferred
24	60	F	Open Reduction and Internal Fixation (Fracture Shaft Femur Left)	100%	Face mask @5L/min	01	Transferred
25	45	M	Marginal Mandibulectomy + Reconstruction (Ca Mandible)	99%	Face mask @5L/min	01	Transferred
26	65	F	Laparoscopic Vaginal Hysterectomy (Uterine Prolapse)	100%	Face mask @5L/min	03	Transferred
27	64	M	Debridement left foot + Biopsy (necrotizing soft tissue infection)	99%	Face mask @5L/min	02	Transferred
28	57	M	Right Lower Limb Debridement (Diabetic Foot)	100%	Room Air	02	Transferred
29	55	M	Neck Exploration (Abscess Neck)	100%	Face mask @5L/min	01	Transferred
30	51	M	Widefield Laryngectomy (Ca Larynx)	100%	Room Air	01	Transferred
31	26	M	Nasopharyngeal Fibroma excision	98%	Face mask@5lit/min	0.5	Transfered
32	50	F	Total Thyroidectomy (Multinodular Goitre)	96%	T - piece@8 lit /min	08	Transfered
33	28	M	Total Thyroidectomy & Radical Neck Dissection (Papillary Ca Thyroid)	98%	Room Air	02	Transferred
34	60	F	Open Cholecystectomy (ca Gall Bladder)	98%	Room Air	03	Transferred
35	22	F	Exploratory Laparotomy (Ectopic pregnancy)	99%	Room Air	01	Transferred
36	46	M	Exploratory laparotomy with resection anastomosis (Intestinal Obstruction)	97%	Room Air	02	Transferred
37	60	F	Near Total Thyroidectomy (Thyroid Nodule)	98%	Face mask@5lit/min	03	Transferred
38	62	M	Partial laminectomy (Traumatic subluxation C3 over C4)	97%	Nasal Prongs@2lit/min	01	Transferred
39	42	M	Near Total Thyroidectomy (Thyroid Nodule)	98%	Room Air	02	Transferred
40	52	F	Bilateral Total Knee Replacement (Osteoarthritis both knees)	96%	Room Air	05	Transferred
41	70	M	Exploratory laparotomy (Perforation Peritonitis)	97%	Face mask@5 lit/min	02	Transferred
42	64	F	Pancreatectomy & Splenectomy (Space Occupying Lesion Pancreas)	96%	Nasal prongs@2 lit/min	04	Transferred
43	54	M	Distal Pancreatectomy (Periampulary Carcinoma)	98%	Face Mask@5 lit/min	07	Transferred
44	22	F	Fibroadenoma Breast (Right)excision	99%	Room Air	01	Transferred
45	47	F	Laparotomy & Proceed (Ca Gall Bladder)	97%	Face mask@5 lit/min	03	Transferred
46	31	F	Frey's procedure + Hepaticojejunostomy (Chronic Pancreatitis + MPD Stone)	97%	Nasal prongs@2 lit/min	02	Transferred
47	39	M	Whipple's Procedure (Ca Head of Pancreas)	98%	Face mask @ 5lit/min	03	Transferred
48	33	F	Total Abdominal Hysterectomy + Bilateral Salpingo-oopherectomy (Abnormal uterine bleeding)	98%	Room Air	04	Transferred
49	68	M	Exploratory laparotomy (Diverticulitis, Peritoneal Abscess)	95%	Face mask@5lit/min	08	Transferred
50	65	M	Burrhole Right Frontoparietal, Bilat Acute on Chronic SDH	99%	Room Air	01	Transferred
51	50	M	Orbital Decompression (Orbital Cellulitis Left)	99%	Room Air	04	Transferred
52	70	M	Excision of Stricture Esophagus	96%	Face mask@5 lit/min	01	Transferred
53	69	M	Open uretrolithotomy (Multiple left uretric calculi)	97%	Face mask@5 lit/min	02	Transferred
54	46	F	Exploratory laparotomy (Ca Cervix with intestinal obstruction)	99%	Room Air	01	Transferred
55	32	M	Decompressive Hemicraniotomy (head Injury + Subdural Hematoma)	98%	Face mask @5 lit/min	03	Transferred
56	42	M	Total Thyroidectomy (Multinodular Goitre)	98%	Face mask @5 lit/min	02	Transferred
57	20	F	Frontal Decompressive Craniotomy (Head Injury)	97%	Face mask@4lit/min	01	Transferrred
58	39	M	Whipple's Procedure (Ca head of pancreas)	97%	Face mask @5lit/min	10	Transferred
59	35	M	Total Laryngectomy (Ca Larynx)	98%	T – piece@8lit/min	01	Transferred
60	36	M	Exploratory Laparotomy (Mesenteric Ischemia)	99%	Naasal prongs@2 lit/min	0.5	Transferred

0.5 Day = 12 hrs and less; 1 Day= 12 to upto 24 hrs

The descriptive statistics show a valid study population of 60 patients with a sex distribution of male patients as 33 out of 60 (55%) and females as 27 out of 60 (45%) depicted in Table 2. The minimum age group was 18 years and maximum was 70 years.

Table 2. Male (M) and female (F) distribution

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	F	27	45.0	45.0	45.0
	M	33	55.0	55.0	100.0
	Total	60	100.0	100.0	

The mode of oxygen delivery, once the patients were received in the surgical ICU, (Table 3) showed a preponderance of oxygen via face mask being used in 35 out of 60 patients (58.3%), oxygen via nasal prongs in 5 out of 60 (8.3%), room air oxygen in 18 out of 60 (30%), while 2 out of 60 (3.3%) were not immediately extubated post-surgery and received oxygen via T piece.

Table 3. Oxygen delivery mode

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	Face Mask	35	58.3	58.3	58.3
	Nasal Prongs	5	8.3	8.3	66.7
	Room Air	18	30.0	30.0	96.7
	T piece	2	3.3	3.3	100.0
	Total	60	100.0	100.0	

The final outcome showed no deaths and all 60 patients (100%) were ultimately transferred out of the surgical ICU (Table 4).

Table 4. Outcome: Transfer/Death

	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	Transferred	60	100.0	100.0	100.0

Table 5 lays out the minimal SpO2 measured immediately postoperatively as 95% and the maximum as 100% with a mean of 98.57% (standard deviation 1.345). The length of stay (LOS) varied from a minimum of one day to a maximum of ten days with a mean of 2.24 days (standard deviation 1.967).

Table 5. Minimum and Maximum (SpO2 in % and LOS in days)

	N	Minimum	Maximum	Mean	Std. Deviation
SPO2 levels	60	95	100	98.57	1.345
Length of stay	60	1	10	2.24	1.967
Valid N (listwise)	60				

Table 6 shows the six hourly SpO2 recording of patients from the time they entered the surgical ICU (Zero hours) till the time they were transferred out (depicted as days) after having met the basic criteria of maintaining a minimum SpO2 of 94%, without any supplementary oxygen, for atleast six hours.

Table 6. Six hourly SpO2 levels of patients:-

S No.	Age (in yrs)	Sex	Type of Surgery	0 hr	6 hrs	12 hrs	24 hrs	2nd Day	3rd Day	4th Day	5th Day	6th Day	≥ 7 Days	LOS in days	Outcome T/D
1	28	F	Nephrectomy (Right)	94%	93%	94%	96%	94%	96%	-	-	-	-	02	T
2	56	F	C1 C2 posterio Sublaminal wiring	99%	99%	94%	96%	-	-	-	-	-	-	01	T
3	37	F	Staging laparotomy	99%	98%	97%	92%	93%	96%	-	-	-	-	02	T
4	37	F	Laparoscopic sleeve gastrectomy	99%	99%	99%	93%	94%	-	-	-	-	-	02	T
5	55	F	Laparoscopic Cholecystectomy	99%	99%	96%	-	-	-	-	-	-	-	01	T
6	36	F	Left subtemporal craniotomy	99%	99%	100%	99%	96%	-	-	-	-	-	02	T
7	60	M	Laminectomy L4-L5	98%	99%	99%	-	-	-	-	-	-	-	01	T
8	50	F	Inguinal Hernia Reduction+mesh repair	99%	99%	-	-	-	-	-	-	-	-	01	T
9	25	F	Laparoscopic Splenectomy	99%	99%	99%	-	-	-	-	-	-	-	01	T
10	68	F	Trans-thoraccic Esophagectomy	96%	99%	97%	-	-	-	-	-	-	-	01	T
11	28	M	Open Reduction and Internal Fixation (ORIF) calcaneum	99%	99%	99%	99%	98%	99%	97%	98%	98%	-	05	T
12	47	F	Laparoscopic Vaginal Hysterectomy	99%	99%	-	-	-	-	-			-	0.5	T
13	51	M	Adrenalectomy (Right)	98%	98%	96%	-		-	-	-	-	-	01	T
14	25	F	Laparoscopic Sleeve Gastrectomy	93%	96%	94%	-	-	-	-	-	-	-	01	T
15	50	F	Left Hepatectomy	99%	98%	99%	-	-	-	-	-	-	--	01	T
16	18	M	Splenectomy	98%	95%	96%	-	-	-	-	-	-	-	01	T
17	21	F	Craniotomy+excision	96%	97%	96%	96%	96%	96%	96%	95%	-	-	03	T
18	65	M	Wound closer (burst abdomen)	99%	99%	98%	95%	96%	96%	95%	95%	-	-	03	T
19	70	M	Nephrectomy Right	95%	98%	99%	-	-	--	-	-	-	-	01	T
20	55	M	Debribment foot	95%	98%	99%	-	-	-	-	-	-	-	01	T
21	65	F	Laparoscopic sleeve gastrectomy	99%	98%	99%	96%	98%	-	-	-	-	-	02	T
22	41	M	Laryngectomy	99%	99%	98%	-	-	-	-	-	-	-	01	T
23	64	M	Lap Rt. Hemicolectomy	99%	99%	97%	-	-	-	-	-	-	-	01	T
24	60	F	Open Reduction and Internal Fixation (Femur shaft)	94%	97%	96%	-	-	-	-	-	-	-	01	T

25	45	M	Marginal Mandibulectomy + Reconstruction	99%	99%	96%	-	-	-	-	-	-	-	01	T
26	65	F	Laparoscopic Vaginal Hysterectomy	98%	99%	97%	98%	98%	96%	97%	97%	-	-	03	T
27	64	M	Debribment + Biopsy	94%	94%	98%	98%	98%	99%	-	-	-	-	02	T
28	57	M	Lower Limb Debribment	96%	97%	97%	98%	98%	-	-	-	-	-	02	T
29	55	M	Neck Exploration	99%	99%	96%	-	-	-	-	-	-	-	01	T
30	51	M	Widefield Laryngectomy	95%	96%	96%	-	-	-	-	-	-	-	01	T
31	26	M	Nasopharyngeal Fibroma excision	98%	98%	-	-	-	-	-	-	-	-	0.5	T
32	50	F	Total Thyroidectomy	96%	97%	96%	96%	97%	95%	96%	97%	98%	98%	08	T
33	28	M	Total Thyroidectomy & Radical Neck Dissection	98%	97%	98%	97%	98%	-	-	-	-	-	02	T
34	60	F	Open Cholecystectomy	98%	97%	98%	98%	99%	99%	-	-	-	-	03	T
35	22	F	Exploratory Laparotomy	99%	98%	99%	99%	-	-	-	-	-	-	01	T
36	46	M	Exploratory laparotomy with resection anastomosis	97%	98%	97%	99%	98%	-	-	-	-	-	02	T
37	60	F	Near Total Thyroidectomy	98%	97%	96%	98%	98%	98%	-	-	-	-	03	T
38	62	M	Partial laminectomy C3 /C4)	97%	97%	98%	98%	-	-	-	-	-	-	01	T
39	42	M	Near Total Thyroidectomy	98%	97%	98%	98%	99%	-	-	-	-	-	02	T
40	52	F	Bilateral Total Knee Replacement	96%	97%	98%	98%	97%	98%	98%	99%	-	-	05	T
41	70	M	Exploratory laparotomy	97%	96%	97%	98%	98%		-	-	-	-	02	T
42	64	F	Pancreatectomy & Splenectomy	96%	97%	97%	98%	97%	98%	98%	-	-	-	04	T
43	54	M	Distal Pancreatectomy	98%	97%	96%	97%	95%	97%	96%	96%	97%	98%	07	T
44	22	F	Fibroadenoma Breast excision	99%	98%	99%	99%	-	-	-	-	-	-	01	T
45	47	F	Laparotomy & Proceed	97%	96%	97%	98%	98%	98%	-	-	-	-	03	T
46	31	F	Frey's procedure + Hepaticojejunostomy	97%	97%	98%	98%	98%	-	-	-	-	-	02	T
47	39	M	Whipple's Procedure	98%	98%	97%	97%	97%	98%	-	-	-	-	03	T
48	33	F	Total Abdominal Hysterectomy + Bilateral Salpingo-oopherectomy	98%	97%	96%	96%	97%	97%	98%	-	-	-	04	T
49	74	M	Exploratory laparotomy	95%	96%	96%	94%	95%	95%	96%	97%	97%	97%	08	T
50	65	M	Burrhole Right Frontoparietal	99%	98%	98%	98%	-	-	-	-	-	-	01	T
51	50	M	Orbital Decompression	99%	98%	97%	98%	98%	99%	98%	-	-	-	04	T
52	70	M	Excision of Stricture Esophagus	96%	97%	97%	98%	-	-	-	-	-	-	01	T
53	70	M	Open uretrolithotomy	97%	96%	97%	96%	97%	-	-	-	-	-	02	T
54	46	F	Exploratory laparotomy	99%	98%	99%	99%	-	-	-	-	-	-	01	T
55	32	M	Decompressive Hemicraniotomy	98%	97%	96%	98%	99%	99%	-	-	-	-	03	T
56	42	M	Total Thyroidectomy	98%	97%	97%	98%	98%	-	-	-	-	-	02	T
57	20	F	Frontal Decompressive Craniotomy	97%	97%	98%	99%	-	-	-	-	-	-	01	T
58	39	M	Whipple's Procedure	97%	97%	96%	97%	95%	93%	94%	96%	97%	97%	10	T
59	35	M	Total Laryngectomy	98%	97%	98%	98%	-	-	-	-	-	-	01	T
60	36	M	Exploratory Laparotomy	99%	99%	-	-	-	-	-	-	-	-	0.5	T

Figure 1 depicts a scatter plot showing the correlation between SpO2 levels over days and LOS which was calculated using Pearson's correlation coefficient r; r= -0.49 (p=0.000); This implied a significant negative correlation between the two variables.

Figure 1. Scatter plot depicting correlation between SpO2 over days and LOS

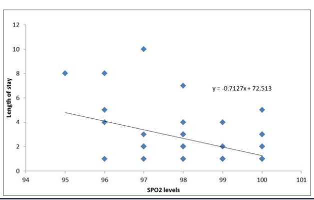
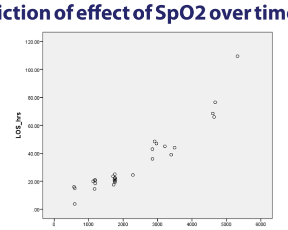


Figure 2 shows the effect of SpO2 over time in hours (r=0.91, p=0.00). This also implies that there is a strong correlation between SpO2 change over time and length of stay.

Figure 2. Depiction of effect of SpO2 over time (LOS) in hours



Discussion

This study showed a significant correlation between oxygen saturation and LOS following major surgery. Physiologically normal SpO2 levels, i.e, between 94% to 100%, correlated with shorter LOS in ICU. Nearly 30% of the patients were able to maintain normal SpO2 levels at room air while the remaining patients received some form of supplemental oxygen (Table 3) which was gradually tapered off over hours or days.

Several factors influence LOS among postsurgical patients. In one study, postoperative patients on the whole were less likely to have prolonged ICU stays than were patients admitted to the ICU for other reasons and were less likely to die during the ICU stay (5). This seemed to be the case in our study too as there was no death noted.

A thorough search of literature online has not revealed any study utilizing solely the SpO2 levels as a tool for correlating LOS in a surgical ICU for postoperative patients. The few studies that came to light mostly pertained to somewhat related issues in medical ICUs, peripheral wards or paediatric population but none in surgical ICUs. A particular study in pneumonia patients revealed that oxygen saturations <90% are associated with increased morbidity and mortality (6). Our study showed a constant steady oxygen saturation levels above 90% with no undue morbidity and mortality. Infact, all our patients showed oxygen saturation levels of 95% and above, with or without oxygen, in the immediate postoperative period.

Further, another study done to determine the effect of intermittent versus continuous pulse oximetry monitoring on hospital length of stay among nonhypoxemic infants and young children hospitalized for bronchiolitis revealed no shortening of hospital length of stay (7). However, studies done in adults using continuous pulse oximetry do point towards it's potential advantage in increasing vigilance and reducing pulmonary complications and thus decreasing intensive care unit (ICU) admissions (8). In contrast to these last two studies our study was done within the ICU and showed the benefit of a simple and handy tool as a pulse oximeter being able to act as a guide to identify acceptable oxygen saturation levels and hence terminating the stay of patients in the ICU by shifting them to the surgical ward.

In a recent study comparing conservative versus standard oxygen therapy in ICU it was found that in critically ill patients with an ICU length of stay of greater than 72 hours, a conservative protocol for oxygen therapy targeting a SpO2 between 94-98% resulted in a lower ICU mortality (9). Our study showed a LOS as short as half a day to as long as ten days. However, these were exceptions to the norm and the mean LOS in ICU was of 2.24 days.

The closest technology to pulse oximetry that has been tried recently to correlate with outcomes in surgical ICU is near-infrared spectroscopy (NIRS) - derived tissue hemoglobin saturation (StO2). Like SpO2, StO2 too is a noninvasive measurement that reflects changes in microcirculatory tissue perfusion. An increase in the number of days with StO2 less than 70% was associated with fewer ventilator-free, ICU-free, hospital-free days, and hence poor outcomes in surgical ICU patients. This NIRS technology represents a potentially useful, noninvasive adjunct to monitoring of critically ill patients (10). However, it is used more commonly in assessing tissue hypoxia in shock, is more expensive and not always available readily.

The uptake of oxygen by tissues (VO2) is normally independent of oxygen delivery (Do2). If delivery fails the oxygen extraction ratio (VO2:DO2) rises to maintain a constant rate of uptake and fulfil tissue demand. Increasing oxygen delivery in these patients should produce a corresponding increase in uptake. However, in practice this is difficult to ascertain because of problems in measurement and the need for tissue oxygen demand to remain constant (11). This is where an easily accessible monitoring tool as a pulse oximeter can go a long way in assessing the oxygenation status and influence the LOS. In our study, the SpO2 levels maintained constancy in the majority of cases. In a few cases where the SpO2 levels did drop to 93%-94%, in the days following the patient's arrival in the ICU post surgery, it was mainly on account of major gastrointestinal intervention or surgery around the neck and airway. Ultimately, based on pulse oximetry, the oxygen saturation levels were found optimized and the patient's stay in ICU was curtailed.

In conclusion, this study depicts a strong correlation between oxygen saturation in patients and LOS in a surgical ICU postoperatively following a major surgery. It emphasizes the fact that a simple modality like pulse oximetry can be used to predict LOS in ICU postoperative patients. A prospective study with a larger database of patients could be undertaken to further validate the findings of this study and throw light on other monitoring parameters to correlate the LOS in an ICU setting.

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Conflicts of interest

There are no conflicts of interest.

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