

## Brief Communication

# Pattern of utilization of facilities in the intensive care unit by elective surgical patients in a tertiary care institution: Can the services be provided by high dependency units in surgical wards?

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### Abstract

#### Introduction

Intensive care is indicated for patients requiring intensive monitoring and/or organ support. It is a costly and time limited resource utilized by those with reversible pathologies and reasonable likelihood of survival. Patients awaiting elective surgery with preoperative intensive care unit (ICU) bookings need to compete with emergency and unanticipated admissions leading to cancellation and postponement of elective surgery, a disadvantage to both the patient and the institution. Hence this study is aimed at evaluating the extent of ICU care utilized by elective surgical patients and to analyse the indications vs. utilization of ICU care by them.

#### Methods


This was a retrospective cross-sectional study carried out in the surgical ICU of Colombo South Teaching Hospital, enrolling 47 elective surgical patients admitted to the ICU over a period of 3 months. Data was collected using a pre structured data collection form.

#### Results

Majority of the patients were middle aged, belonged to the American Society of Anaesthesiologists Physical Status 2 (68.1%) and underwent colorectal (26%), upper gastrointestinal (GI) (15%) or hepatobiliary (13%) surgeries. Main comorbidities amongst the study population were diabetes and hypertension. Mean duration of ICU stay was 2 days. Most patients were monitored non-invasively within the ICU (68%). Organ support was required by only 17% of patients. Most frequent indication for preoperative ICU booking was the surgical/anaesthetic complexity determined by British United Provident Association (BUPA) schedule of procedures (83%). However, ICU resources were mainly utilized for provision of analgesia particularly in the form of epidural infusions (52%).

#### Recommendations

We recommend the development of level 2 care/high dependency units to reduce the burden on the ICU and a unit-based policy for ICU resource allocation for surgical patients.

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## Introduction

Intensive care is indicated for patients needing intense monitoring and/or organ support. However, as the intensive care facility is a costly and limited resource it is usually utilized for those with reversible pathologies having a reasonable likelihood of survival. The consensus is that the too ill to benefit and the too well to utilize groups should not be admitted to the intensive care unit (ICU) [1] An exception would be a potential organ donor). Nevertheless, the too ill to benefit group is becoming harder to define with advances in medicine and this has led to an even greater increase in the demand for ICU beds.

Allocation of these resources on the ground of relative medical benefit is commonly called "triage" [2]. "Rationing" or withdrawal of medically beneficial services by a medical expert because it costs someone other than the patient is another method used during ICU resource allocation [2].

Patients awaiting elective surgery sometimes require advance ICU bookings to proceed with surgery. They need to compete with emergency and unanticipated admissions to the ICU. This has led to many cancellations and postponements of surgery, which is disadvantageous to the patient and the institution as these patients often have conditions which need early surgery, to prevent rapid advance of the disease or improve patient survival/outcome. Therefore, requests for preoperative ICU bookings should be well justified. There are a multitude of other reasons why surgeries are cancelled [2], but these are generally unpredictable and nonpreventable.

While there is some guidance to ICU admissions in general [3], there is no single system specific for elective surgery. Predictors of mortality to identify patients at high risk are often used to guide the necessity of an ICU bed for the patient [2]. There are several risk categories used for these predictions. Preoperative clinical risk scores such as the ASA PS (American Society of Anaesthesiologists physical status) score is an estimation of population risk, while the Charlson comorbidity index and the Lees revised cardiac index scores estimate individual risk. There are combined clinical and surgical scores using perioperative data such as the P-POSSUM (Portsmouth-Physiological and Operative Score for the enumeration of Mortality and Morbidity) score [4,5]. The complexity of the surgery has been graded for costing purposes by BUPA (British United Provident Association). The BUPA Schedule of Procedures classifies clinical procedures into 25 categories, ranging from CMO5 (Complex Major Operation – Hardest degree) to Minor 1 (Minor procedure - simplest) based on the clinical classification and schedule development group of the United Kingdom coding system [6]. This can also be used as a guide to indicate which cases require ICU booking. Commonly, a combination of the above along with rationing and institution specific selection criteria are used.

The Colombo South Teaching Hospital is a state-run teaching hospital with one 8-bedded general surgical ICU and one 5-bedded general medical ICU. The ICU is utilised to provide organ support such as inotropic vasopressor support for the cardiovascular system, ventilatory support for the respiratory system and renal replacement therapies for the

renal system. Other facilities utilised are intense monitoring using invasive techniques and provision of analgesia for complex surgeries. There are very few studies which evaluate the relationship between indications for ICU admissions and outcome and even fewer studying indications vs utilisation of ICU care. A retrospective study done by Usman et al. in a tertiary care institution over 5 years including 1756 post-operative patients showed that despite ICU care, patients with haemodynamic or metabolic instability with high American Society of Anesthesiologists (ASA) or APACHE II scores and low Glasgow coma scales (GCS) had a higher mortality [7]. Cutuli et al. showed that the post-operative outcome of elective surgical patients was not directly related to ICU care. They suggested a patient-based, customized risk stratification system for resource allocation [8]. Kahan et al. demonstrated, in a prospective study involving 27 countries, that critical care admission following elective surgery was not associated with a survival benefit [9]. Therefore, a study assessing ICU indications and utilization is an unmet need. This study can be used to help justify the need for ICU booking /cancellation of elective surgeries in the future.

## Objectives

The objective of this study was to evaluate the extent of utilization of facilities in the ICU by elective surgical patients who have been pre-planned to be admitted to the ICU. The aim was to analyse the extent of ICU facilities utilized by them and whether the ICU can be replaced by an HDU for these patients.

## Methods

This was a retrospective, cross-sectional study conducted at the Surgical Intensive Care Unit of the Colombo South Teaching Hospital. The study population consisted of 47 patients over 18 years of age having a pre-operative booking for an ICU bed for elective, noncardiac, non-neurological surgeries and admitted to the ICU for post-operative care. Only elective surgical patients with a preoperative ICU booking were selected because the aim of the study was to analyse the extent of ICU facilities utilized by them and whether the need for ICU could be replaced by an HDU for these patients.

Data was collected retrospectively, from 12.04.18 to 13.07.18, using a pre-structured data collection form. The patients were selected from the ICU admissions book. The data was obtained from bed head tickets, ICU charts and the ICU booking diary. The data collected were demographic details, data needed to compile the ASA status/surgical complexity, indication for ICU admission, surgical data and ICU facilities utilised. Data analysis was done using the SPSS 22.0 computer software. Ethics approval was obtained from the Colombo South Teaching Hospital ethics review committee. This study was a self-funded study.

## Results

There was a female preponderance in the study population n=31(66%). The age ranged from 28 years to 84 years with a mean of 56 years. Eleven (23%) were over 70 years of age. The duration of ICU stay was on average just above 43 hours (just under 2 days) with the shortest stay being 2 hours and the longest stay 190 hours.

The ASA physical status score ranged from ASA PS 1 to ASA PS3. Of the total, 13(27.7%) were ASA 1 and the majority 32(68.1%) were ASA 2. There were only three patients with an ASA PS of 3.

Of the total, 15 had hypertension, 12 had type II diabetes mellitus and 7 had both conditions. None had bronchial asthma. Documented comorbidities are listed in Figure 1.

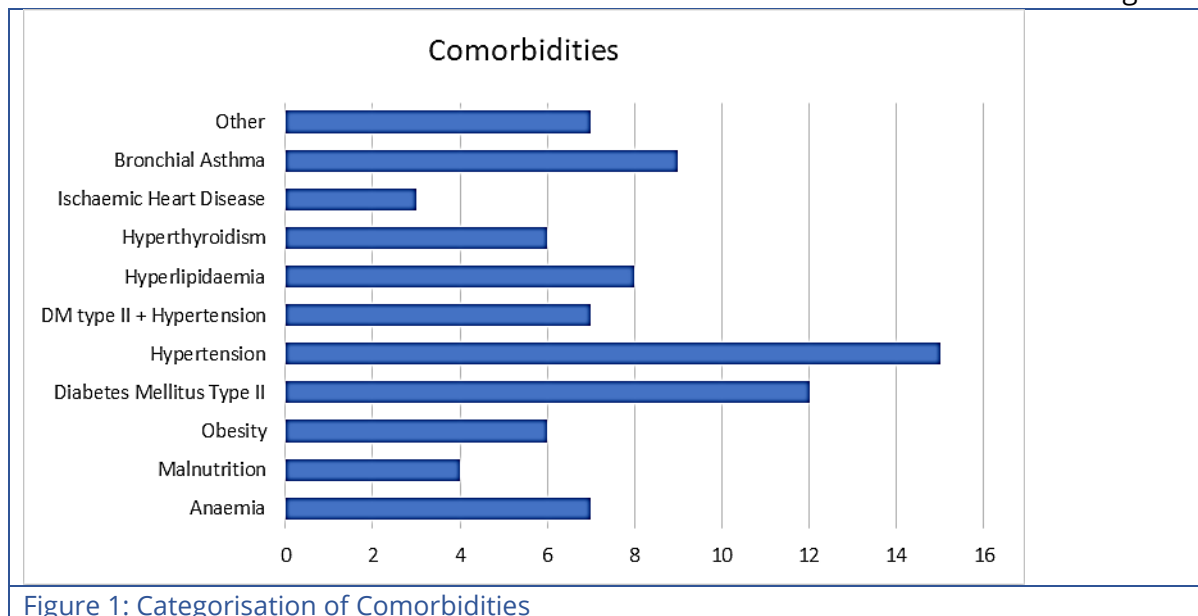


Figure 1: Categorisation of Comorbidities

### Surgery Related Factors

The surgical procedures were coded according to the BUPA schedule of procedures. Procedures with the CMO prefix were considered as complex major cases.

Twenty-five procedures qualified as complex major while all the rest were major cases. No intermediate or minor cases were found.

The specialities/body systems of the operations were categorised as upper gastrointestinal, hepatobiliary, colorectal, endocrine, genitourinary, liver and other (Figure 2). The commonest elective surgery requiring and utilising the ICU was colorectal surgery (12 patients, 26%). Regarding the 'other' category, one patient underwent plastic surgery while another had an airway/oto-rhino-laryngological surgery.

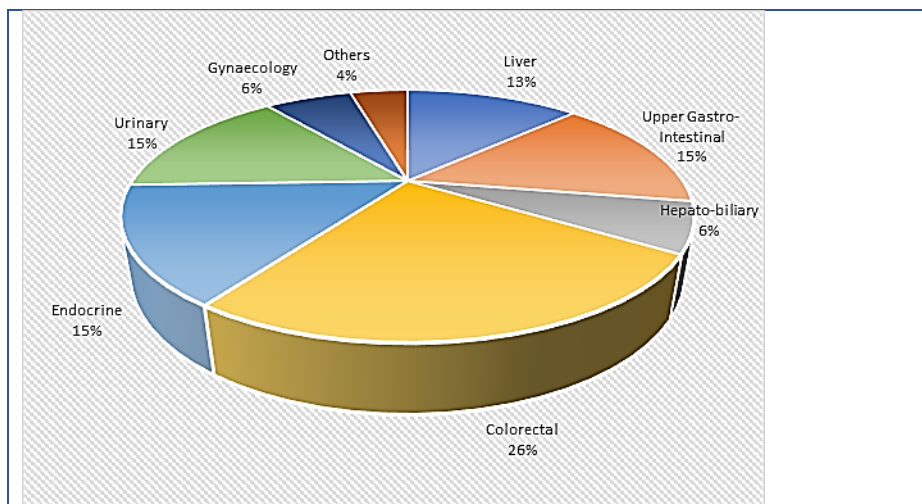


Figure 2: Categorisation of surgery by speciality/body system involved

There were 28 surgeries (60%) done for malignancy related disease, of which one was corrective surgery following chemoradiotherapy for a gynaecological malignancy.

### Indications for ICU Admission

In a majority of cases (83%) the indication for ICU admission was complex major or major surgery.

Table 1: Indication for ICU admission

Indication for admission to ICU	N(%)
For endotracheal tube (ETT) only	5(10.6)
American Society of Anesthesiologists physical status (ASA PS) classification 3	3(6.4)
Complex surgery	39(83.0)
Total	47(100.0)

### ICU Resource Utilisation

The ICU resources used were system support (Figure 3), monitoring (Table 2) and analgesia (Table 3). Only 8 patients received one or more of cardiovascular, respiratory or other support. Five patients needed ICU care only to manage the endotracheal tube. Two were infused octreotide and 3 needed intravenous insulin infusions.

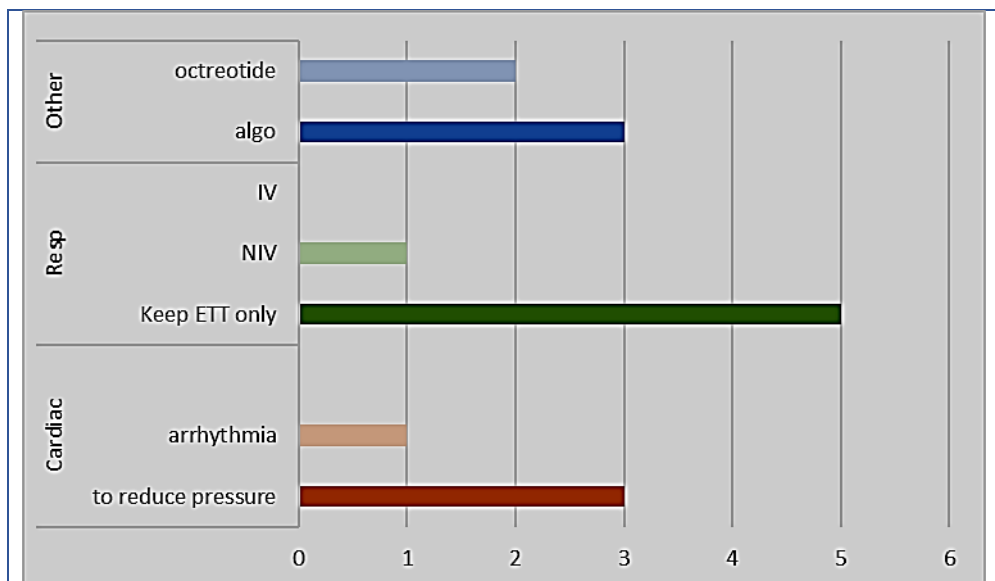


Figure 3: Supports utilized while in ICU

Invasive monitoring methods that were used were intraarterial blood pressure monitoring alone (10 patients, 21.3%) or in combination with central venous pressure monitoring (5 patients). Most (32 patients, 68%) were monitored by non-invasive means.

**Table 2: Level of monitoring in ICU**

Level of monitoring in ICU	N(%)
Non-invasive IABP	5(10.6)
Invasive IABP	10(21.3)
Invasive IABP + CVP	32(68.1)
Total	47(100.0)

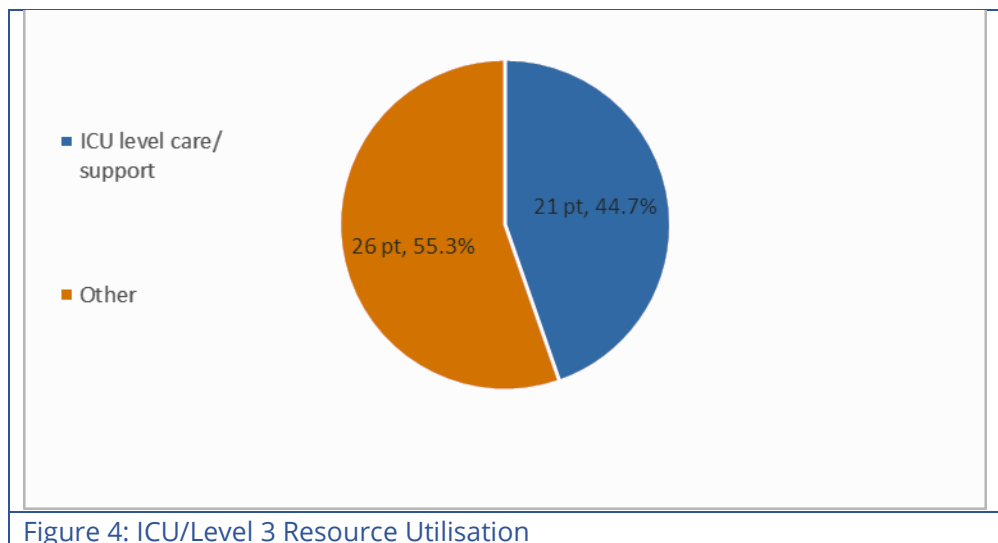
IABP = intra-aortic balloon pump, CVP= Central venous pressure

The commonest mode of analgesia used was epidural analgesia (53%). Intravenous morphine was used in 6 patients, of whom one received patient controlled analgesia.

**Table 3: Mode of analgesia**

Mode of analgesia	N(%)
Epidural infusion	25(53.19)
Intravenous morphine	6(12.70)
Other	16(34.04)
Total	47(100.00)

Considering level 3 ICU care (invasive ventilation, vasopressor infusions, invasive monitoring) less than half (21 patients, 46.7%) of the study population utilised this level of care.



## Discussion

The Colombo South Teaching Hospital is a hub for upper gastrointestinal, liver and colorectal surgery. This is seen in the significant representation of colorectal (26%), upper GI (15%) and liver (13%) surgeries in this group. Most of the study sample were middle aged. Around 23% were over 70 years.

Generally, patients were kept in the ICU for just under 2 days, allowing their physiology to stabilize and to detect early complications. It is during this period that patients need intense monitoring. This may be a reason for the average duration to be 2 days.

The most common ASA PS was ASA PS2. This is probably because most patients are optimised prior to surgery after being seen by in the pre-anaesthetic clinic. Comorbidities that were commonest were Type II diabetes mellitus and hypertension. This is most likely due to the middle-aged nature of the study population.

The BUPA schedule of procedures is used in the United Kingdom and BUPA based countries to calculate remuneration with regards to health insurance coverage. It classifies the procedures using the CSSD (clinical classification and schedule development group) coding system. Codes are given for surgical and anaesthetic complexity; length of hospital stay etc. [6]. According to BUPA, the study group included a significant percentage of complex major and major surgeries as well as major anaesthetic complexity. This was also the most frequent indication for preoperative ICU booking.

The ICU resources used were mostly for provision of analgesia. This may be because ward staff are not equipped in skill or manpower (or both) to provide and monitor intensive analgesia in the form of epidural infusions. Invasive monitoring and analgesic infusions can be given at a level 2 facility. Setting up a level 2 facility (high dependency unit) could significantly reduce the level 3 (ICU) load. It has been shown that such stepdown units allow earlier, yet safer, discharge from high level care enabling patients who were previously too difficult to be managed on the ward to be looked after [10].

The cardiac support that was utilised was to reduce the blood pressure. There were no patient's requiring vasopressor support in this group. A single patient required non-invasive ventilatory support, while nobody needed re-intubation followed by invasive ventilation. None required any form of renal replacement therapy (CRRT- continuous renal replacement therapy and IHD-Intermittent Haemodialysis are available at CSTH). This contrasts with the patients in the medical intensive care unit and septic patients in ICUs of whom a significant proportion require ventilatory support and renal replacement therapies. A study done by Henning et al. showed that 30% of SICU patients were admitted strictly for monitoring purposes and never received any active interventions. According to Henning et al. this was true for 40% of MICU (Medical ICU) patients as well [11].

### Limitations

1. The study population size may be inadequate to power conclusions on.
2. This is a single centre study and therefore may not be applicable to institutions with a different caseload and facilities
3. It was a retrospective study utilising available documentation which was sometimes wanting in content and detail.
4. The cases postponed due to lack of beds and the outcome of patients prebooked for ICU who underwent surgery without ICU beds was not determined by this study.

### Conclusions

Majority (68.1%) of patients were categorised as of American Society of Anaesthesiologists Physical Status 2. Colorectal (26%), upper gastrointestinal (15%) and liver (13%) surgeries were the commonest. The main indication for preoperative ICU booking was surgical/anaesthetic complexity determined by the BUPA schedule of procedures. ICU was utilised for an average of 2 days, predominantly for the provision of epidural analgesia infusions.

### Recommendations

The authors recommend the development of level 2 care/high dependency units (HDU) to reduce the burden in the ICU, a unit-based policy of ICU resource allocation for surgical patients and dedicated nursing staff equipped to handle the functions of the high dependency units.

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