

# Unexpected events occurring during the intra-hospital transport of critically ill ICU patients

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## Abstract

**Background:** Intra-hospital transport of critically ill patients is a challenging task. However, despite the improvements in intra-hospital transport practices, adverse event incidents remain high and constitute a significant risk for the transport of the critically ill ICU patients. **Objectives:** To observe the number and types of unexpected-events (UEs) occurring during intra-hospital transport of critically ill ICU patients. Interventions provided along with outcome. **Materials and Methods:** This was a prospective observational study of 254 intra-hospital critically-ill ICU patients of our hospital transported for diagnostic purposes during April 2012 - March 2013. The escorting intensivist completed the data of unexpected events during transport. **Results:** A total of 254 patients were observed prospectively for UEs during intra-hospital transfer of critically ill patients. The overall UEs observed were 139 among 64 patients. Among the UEs which occurred, the maximum were miscellaneous causes [89 (64.00%)] like oxygen probe [38 (27.33%)] or ECG lead displacement [27 (19.42%)]. Major events like fall in spo<sub>2</sub> >5% observed in 15 (10.79%) patients, BP variation > 20% from baseline in 22 (15.82%) patients, altered mental status in 5 (3.59%), and arrhythmias in 6 (4.31%) patients. Among 64 (100%) patients with UEs, 3 (2.15%) patients with serious adverse events have been aborted from transport. **Conclusion:** Unexpected-events (UEs) are common during transport of critically ill ICU patients and these adverse events can be reduced when critically ill patients are accompanied by intensivist/medically qualified person during transport and following strict transport guidelines.

**Keywords:** Adverse events, intra-hospital transport, intensivist, unexpected events

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## Introduction

Intra-hospital transport of critically ill patients is a challenging task because patients are often cared for in unusual environments such as hallways, elevators, and procedure areas not typically designed for critical care monitoring or interventions.<sup>[1]</sup> Practice guidelines have been established in an attempt to define the standard of care for the intra-hospital transport of critically ill patients.<sup>[1-6]</sup> The reported incidents of adverse events during intra-hospital transport range from 6% to as high as 70%.<sup>[7]</sup> These adverse events may be minor events

such as intravenous line displacement or nasogastric tube displacement to major events like cardiac arrest or death. Successful intra-hospital transport directly depends on the planning and organization of the multidisciplinary team as well as appropriate monitoring and intervention during the transport.<sup>[8,9]</sup> However, despite the improvements in intra-hospital transport practices, adverse events incidents remains high and constitutes a significant risk for the transport of the critically ill patients.<sup>[10,11]</sup> The concept of using dedicated transport teams within various patient care units or departments in hospital has been studied, which included the physicians, ICU nurses, and respiratory therapist. This study was conducted to observe the incidents and type of unexpected events (UE's) occurring during hospital transport of critically ill ICU patients when intensivist is accompanying the critically ill patients.

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## Materials and Methods

This was a prospective observational study of 254 intra-hospital critically ill ICU patients transported during April 2012 to March 2013 in a tertiary hospital. The baseline characteristics of patients involved in the study has been shown in Table 1 (Level-3 transport means vasoactive agents are not being actively titrated, nor discontinuation of a vasoactive agent does not result in hemodynamic instability during transport or ventilatory settings with FIO<sub>2</sub> ≤ 0.4 and PEEP ≤ 5 cm H<sub>2</sub>O. In non-intubated patients, the Fio<sub>2</sub> ≤ 0.5 and respiratory rate ≤ 25 breaths per minute. Level-4 transport means continued manipulation of vasoactive infusions to maintain hemodynamic stability during transport or ventilatory settings with FIO<sub>2</sub> >0.4 and PEEP >5 cm H<sub>2</sub>O. In non-intubated patients, the Fio<sub>2</sub> >0.5 and respiratory rate >25 breaths per minute).

These 254 patients were grouped according to the disease system involved, which is shown in the Table 2.

The unexpected events observed were grouped into major, minor, and miscellaneous events as shown in

**Table 1: Baseline characteristics of patients involved in the study**

Baseline characters	Patients: No (%).
Sex- male	137 (53.93)
Female	117 (46.06)
Age (mean)	56.67 years
Level of transport- level III	104 (40.94)
Level IV	150 (59.05)
Transport destination- CT scan	172 (67.71)
MRI	82 (32.28)
Intubated/not intubated	59 (23.22)/195 (76.71)
Vitals before shifting-pulse rate (mean)	88.03
Systolic blood pressure (mean)	139.81
Diastolic blood pressure (mean)	79.59
SpO <sub>2</sub> (mean)	97.80
SOFA (mean)	2.625
APACHE (mean)	9.90

MRI: Magnetic resonance imaging; CT: Computed tomography

**Table 2: Number of patients based on disease system involved**

Disease system	Patients: No (%).
Cerebral infarct	71 (27.95)
Intracerebral hemorrhage	56 (22.04)
Encephalitis	25 (9.84)
Seizures	16 (6.29)
Pneumonia	38 (14.96)
Pancreatitis	9 (3.54)
Intestinal obstruction	2 (0.78)
Abdominal mass	2 (0.78)
Abdominal sepsis	9 (3.54)
Budd chiari syndrome	3 (1.18)
Road traffic accident	23 (9.05)
Total	254 (100)

Table 3. These UE's were monitored during the transport by the escorting intensivist who completed the data during or just after the completion of transport.

## Results

A total of 254 patients were observed prospectively for UEs during intra-hospital transfer of critically ill patients. The overall UEs observed were 139 among 64 patients, which are shown in Table 3. Among the UEs which occurred, the maximum were miscellaneous causes [89 (64.00%)] like oxygen probe [38 (27.33%)] or ECG lead displacement [27 (19.42%)]. Major events like fall in spo<sub>2</sub> >5% observed in 15 (10.79%) patients, BP variation >20% from baseline in 22 (15.82%) patients, altered mental status in 5 (3.59%), and arrhythmias in 6 (4.31%) patients. The total major events were 48 (29 major events in intubated patients and 19 in non-intubated patients). Among 64 (100%) patients with UEs, 3 (2.15%) patients with serious adverse events have been aborted from transport because one patient had >20% fall in blood pressure and two patients had >8% fall in spo<sub>2</sub>. There was no mortality. Majority of UE's were miscellaneous, which received simple interventions, and fewer patients had major UE's. The interventions provided were listed in Table 4.

## Discussion

The UE's which occur can be due to physiological impact of transport such as movement of patient (Acceleration and Deceleration), change in posture, and movement

**Table 3: Unexpected events measured and adverse events encountered during intra-hospital transfer of critically ill ICU patients**

Adverse events	No (%).
Major unexpected events	
SpO <sub>2</sub> fall >5% from baseline	15 (10.79)
Blood pressure variation >20% from-baseline	22 (15.82)
Cardiac arrest	0
Arrhythmias	6 (4.31)
Altered mental status	5 (3.59)
Accidental extubation	0
Minor unexpected events	
Nasogastric tube displacement	2 (1.43)
IV line displacement	0
Miscellaneous	
Oxygen probe tangle/displacement	38 (27.33)
Ecg lead displacement	27 (19.42)
IV line tangle	7 (5.03)
Ventilator failure	0
Low monitor battery	0
Arterial line tangle	0
Delayed transport	14 (10.07)
Aborted transport	3 (2.15)
Trapped in lift	0
Total events	139 (100)

ICU: Intensive care unit

**Table 4: Types of intervention provided**

Active interventions provided	No (%).
Miscellaneous	94 (74.60)
Suctioning of ett	2 (1.58)
IV fluids	2 (1.58)
Supplemental oxygen	2 (1.58)
Muscle relaxants	4 (3.17)
Sedatives	22 (17.46)
Vasoactive agents	0
Atropine	0
Intubation	0
Total number of interventions	126 (100).

from one surface to other<sup>[12-14]</sup> or due to change in environment (from ICU to procedure room).<sup>[15]</sup> The global incidence of UE's has known to reach 68%,<sup>[11]</sup> but if only serious UE's requiring therapeutic interventions are taken into account, the incidence ranges from 4.2% to 8.9%.<sup>[10,11]</sup> The major UE's with life-threatening disturbances that require interventions such as administration of vasopressors, fluid boluses or even CPR may be as high as 8%.<sup>[16-19]</sup> It is difficult to compare incidence of UE's with various studies because of the number of patient population they included, their definition of UE's, where patients are transported, the duration of transport, and how critically ill the patients were. The baseline characteristics of patients involved in the study has been shown in Table 1. One hundred and seventy-two patients (67.71%) were transported to CT scan, and 82 patients (32.28%) were transported for MRI scan. Fifty-nine patients (23.22%) were already intubated patients and 195 (76.71%) were without intubation. The unexpected events observed were grouped into major, minor, and miscellaneous events as shown in Table 3. These UE's were monitored during the transport by the escorting intensivist who completed the data during or just after the completion of transport. Many of these studies which conducted earlier have grouped the UE's as major, minor, and miscellaneous events or even classified as patient-related, equipment-related, and transport team-related UE's.

These 254 patients were grouped according to the disease system involved, which is shown in Table 2. The central nervous system events-related transport included 168 patients (66.12%), pneumonia 38 patients (14.96%), and gastrointestinal system events-related transport were 48 patients (18.92). The number of personnel involved in transport was not found to influence the rate of complication. Recent study shows the rate of complication decreased if patient is accompanied by trained transport team.<sup>[20]</sup> We observed 254 patients for UEs during intra-hospital transfer of critically ill patients. The overall UEs observed were 139 among 64 patients, which are shown in Table 3. Among the

UEs which occurred, the maximum were miscellaneous causes [89 (64.00%)] like oxygen probe [38 (27.33%)] or ECG lead displacement [27 (19.42%)]. Major events like fall in spo<sub>2</sub> >5% observed in 15 (10.79%) patients, BP variation >20% from baseline in 22 (15.82%) patients, altered mental status in 5 (3.59%), and arrhythmias in 6 (4.31%) patients. Among 64 (100%) patients with UEs, 3 (2.15%) patients with serious adverse events have been aborted from transport because one patient had >20% fall in blood pressure and two patients had >8% fall in spo<sub>2</sub>. There was no death during transport. The earlier report by Taylor *et al.* in 1970 who monitored the cardiac patients during intra-hospital transport.<sup>[21]</sup> They had cardiac UE's of about 84% of transport and in them, 44% received emergency treatment. More recent reports shows overall incidence of UE's during intra-hospital transport to range from 6% to 71.1%.<sup>[16-20,22-27]</sup> The cardiovascular UE's were noted up to 47%.<sup>[26,27]</sup> in which they had hypotension and arrhythmias as predominant. Respiratory complications were reported up to 29%,<sup>[24,25]</sup> in which they had increase in respiratory rate and decrease in spo<sub>2</sub> as major complications. Smith *et al.*<sup>[17]</sup> reported mishaps, which occurred in 34% of cases; most of it are related to equipment and monitoring like ECG lead disconnection in 23%, monitor power failure in 14%, and combination of these in 10%. Intravenous or vasopressors infusion disconnection were observed in 9% and 5%, respectively. Most mishaps were noted at the destination site either before or during the procedure. Wallen *et al.*<sup>[16]</sup> reported equipment-related mishaps in 10% of cases; these included malfunctions of equipment or loss of nasogastric tube or chest tube or endotracheal tube. Andrews *et al.*<sup>[23]</sup> transported 27 pts (head injury) to procedure room or OT and observed UE's in 51%, majority of them being due to decrease in BP and spo<sub>2</sub> and increase in intracranial pressure. The interventions provided were listed in Table 4. Majority of UE's were miscellaneous, which received simple interventions and fewer patients had major UE's. As many of the studies done in the past suggested UE's occurring when the patient is accompanied by a physician or ICU nurse and respiratory technician, in our study, the patients were accompanied by an intensivist.

## Conclusion

Unexpected-events (UEs) are commonly seen in critically ill ICU patients who are transported from one place to another. Since these patients have impaired physiological parameters and are being shifted from an observational area (ICU) to a procedural area where there may not be equipment and skilled personnel to monitor the patient adequately, these are vulnerable moments for the patient. These UE's can be reduced when critically

ill patients are accompanied by a qualified person such as an intensivist who implements well established protocols.

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