International Emergency Nursing xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

International Emergency Nursing

journal homepage: www.elsevier.com/locate/aaen

Patient safety incidents during interhospital transport of patients: A prospective analysis

Cathelijne Lyphout[a,*], Jochen Bergs[b], Willem Stockman[c], Koen Deschilder[c], Christophe Duchatelet[a], Didier Desruelles[d], Koen Bronselaer[d]

[a] Emergency Department, University Hospital Ghent, Ghent, Belgium
[b] Faculty of Medicine and Life Sciences, Hasselt University, Hasselt, Belgium
[c] ICU department en MICU Roeselare, AZ Delta, Roeselare, Belgium
[d] Emergency Department, University Hospitals Leuven, Leuven, Belgium

ARTICLE INFO

Keywords:
Emergency medical services
Patient transfer
Interhospital transport
Patient safety
Risk management
Adverse events

ABSTRACT

Introduction: Interhospital transport of critically ill patients is at risk of complications. The objective of the study was to prospectively record patient safety incidents that occurred during interhospital transports and to determine their risk factors.

Methods: We prospectively collected data during a fifteen-month period in 2 hospitals. Patient and transport characteristics were collected using a specifically designed tool. Patient safety incidents were appraised for health-care associated harm, and categorized as technical, operational, and communication problems.

Results: Our study included 688 patients who were transferred to or from one of both hospitals by physician or nurse led transport, with complete records. A patient safety incident was reported in 16.7% of transports, health-care associated harm was noted in 3.9% of cases. In multivariate analysis, three factors remained significantly associated with an increased risk of healthcare-associated harm: operational incidents (odds ratio = 144.93, 95% CI = 37.55–767.50, P < 0.001), communication incidents (odds ratio = 11.05, 95% CI = 3.02–52.99, P < 0.001) and the Modified Sequential Organ Failure Assessment (M-SOFA) score (odds ratio = 1.198, 95% CI = 1.038–1.40, P = 0.017).

Conclusions: The observed rate of patient safety incidents during interhospital transfers is lower than previously reported in the literature. However, there is limited previous work done on this topic. Operational and communication incidents, and a higher M-SOFA score are significantly associated with increase odds of harmful incident. These findings call for stricter preparation of transfers, with clear and standardized communication.

1. Introduction

Based on both cost-efficiency considerations and research findings indicating improved outcomes, specialist services and medical technology resources have been centralised into high-volume specialist centres during the past decades [1–4]. Resulting from this evolution, the need for patient transfers between hospitals has increased. This demand will likely increase, as the establishment of high-volume specialist centres is expected to surge in the near future [5]. Indications for interhospital transport are diverse; they include both post-primary (i.e., where the patient is still in the emergency department of the referring facility), and secondary indications (i.e., where the patient has been admitted to the intensive care unit but requires a transfer to another hospital for specialist care, or referral back after specialist care has been provided) [5]. Patients requiring interhospital transportation are, in several ways, vulnerable to even minor problems during transport. This is because they are often at extremes of age (i.e., paediatric and geriatric population), physiologically unstable, or at high risk of becoming unstable during transfer as they present themselves with unresolved, evolving, or incompletely evaluated medical problems [6,7]. Besides, considerable resource constraints apply during transportation compared to the emergency department or intensive care unit (e.g., a small number of personnel work in a physically restricted space, limited equipment, drugs, and other consumables). Altogether, interhospital transport of patients holds risk for both patient and transport team [7,8]. Hence, patient transport may adversely affect the patient's clinical status, potentially resulting in periods of clinical instability.

Despite risks of interhospital transfers being extensively discussed

* Corresponding author.
E-mail addresses: cathelijne.lyphout@uzgent.be (C. Lyphout), jochen.bergs@uhasselt.be (J. Bergs), Willem.Stockman@azdelta.be (W. Stockman), Koen@paramedicalassistance.be (K. Deschilder), Christophe.duchatelet@ugent.be (C. Duchatelet), didier.desruelles@uzleuven.be (D. Desruelles), koen.bronselaer@uzleuven.be (K. Bronselaer).

http://dx.doi.org/10.1016/j.ienj.2017.07.008
Received 17 January 2017; Received in revised form 16 July 2017; Accepted 19 July 2017

and acknowledged, limited data is available on incidents occurring during transfers. The main body of evidence is based on case series and cohort studies [6,9–12]. The reported incidence—often derived from paediatric data—varies from 3 to 75%, due to differing methods and definitions [13]. The incidence of patient safety incidents is reported to be proportional to the duration of the transfer, to the pre-transfer severity of illness or injury, and to the inexperience of the medical escorts [13].

To obtain a better understanding of the scope, relevance, and modalities of patient safety incidents during interhospital transport of patients, we prospectively studied all patients transferred from two hospitals in Belgium during a fifteen-month period. We also hoped to identify risk factors for these patient safety incidents by reviewing trends in the collected data.

2. Methods

2.1. Design and setting

A prospective, multicentre, cohort design was chosen to analyse the occurrence of patient safety incidents during interhospital transports. Data was collected over a fifteen-month period from 2 Belgian hospitals. Hospital 1 is a university teaching hospital and tertiary referral centre for all pathology, with 1955 beds and 104 intensive care unit (ICU) beds. Hospital 2 is a secondary referral centre—mainly for cardiology and neurosurgery—and a teaching hospital, with 533 beds and 26 ICU beds.

Both hospitals meet the most recent guidelines for the transport of critically ill adult patients, concerning equipment, staffing, and safety [14]. Hospital 1 uses both a contracted helicopter and its own dedicated vehicle (Mobile Intensive Care Unit, MICU) to effect transfers. The MICU is staffed by a driver (emergency medical technician); a doctor (emergency medicine or anaesthesiology trainee year 3–6) and an experienced ED nurse. All nursing staff have additional ED/ICU certification. For helicopter transports, a private helicopter and pilot are contracted, with the same hospital staffing. Hospital 2 contracts a private ambulance service with MICU, staffed by a driver (emergency medical technician) and an anaesthesiology-technician or an experienced ED/ICU hospital nurse, supplemented by a hospital doctor (usually an anaesthesiologist with ICU certification, or an emergency medicine or anaesthesiology trainee year 3–4) if a medical escort is deemed appropriate. All equipment necessary for advanced respiratory support, invasive and non-invasive haemodynamic monitoring, cardiac pacing and defibrillation, venous access and airway management is carried. Extracorporeal life support (e.g., intra-aortic balloon pump, ECMO) can be transported in both MICUs. An extensive on-board pharmacy with fluids, sedation and cardio-active medication is available.

2.2. Study population

All adult patients (>16 years) who underwent a time-critical (i.e., unplanned and acute) or electively planned interhospital transport between August 2013 and October 2014 were eligible for inclusion.

2.3. Definition and taxonomy of patient safety incidents

Patient safety incidents (i.e., an event or circumstance which could have resulted, or did result, in unnecessary harm to a patient) were categorized as following incident types: technical, operational, or communication incidents [15]. Technical incidents were encountered when a problem with the ambulance or a medical appliance occurred. Operational incidents were incidents resulting from an erroneous use of medication or medical appliances. Communication incidents were incidents caused by missing or faulty communication between the transfer team and referring or accepting facility. The three main categories were divided into subcategories, illustrated in Table 1.

Table 1
Subcategories of patient safety incidents.

	Hospital 1 (n = 189) n (%)	Hospital 2 (n = 499) n (%)	Total (n = 688) n (%)
Patient safety incidents	81 (42.8)	65 (13.0)	115 (16.7)
Technical incidents	29 (15.3)	19 (3.8)	48 (7.0)
1. Ambulance	12 (6.3)	3 (0.6)	15 (2.2)
a. Power supply	3 (1.6)	2 (0.4)	5 (0.7)
b. Gas supply	3 (1.6)	1 (0.2)	4 (0.6)
c. Stretcher/Loading bridge	5 (2.6)	2 (0.4)	7 (1.0)
d. Risky traffic situation	0 (0)	1 (0.2)	1 (0.1)
2. Mobile medical appliances	18 (9.5)	17 (3.4)	35 (5.1)
a. Monitoring	14 (7.4)	10 (2.0)	24 (3.5)
b. Respirator	4 (2.1)	3 (0.6)	7 (1.0)
c. Medication	4 (2.1)	6 (1.2)	10 (1.5)
Operational incidents	23 (12.2)	12 (2.4)	35 (5.1)
1. Monitoring	11 (5.8)	4 (0.8)	15 (2.2)
2. Hemodynamic	7 (3.7)	6 (1.2)	13 (1.9)
3. Respiratory	6 (3.2)	2 (0.4)	8 (1.2)
4. Drug-related	4 (2.1)	1 (0.2)	5 (0.7)
5. Injury due to transportation	1 (0.5)	0 (0)	1 (0.1)
6. Clinical deterioration	6 (3.2)	5 (1.0)	11 (1.6)
* Inherent to pathology	6 (3.2)	5 (1.0)	11 (1.6)
Communication incidents	54 (28.6)	57 (11.4)	111 (16.1)
1. Requested level of care	10 (5.3)	9 (1.8)	19 (2.8)
2. Concordance with description	17 (9.0)	22 (4.4)	39 (5.7)
3. Administrative problem	2 (1.1)	17 (3.4)	19 (2.8)
4. Wrong timeframe	14 (7.4)	12 (2.4)	26 (3.8)
5. Equipment insufficiency	15 (8.0)	8 (1.6)	23 (3.4)

All patient safety incidents were appraised and categorized into a no harm incident (i.e., an incident which reached a patient but no discernible harm resulted) or a healthcare-associated harmful incident (i.e., a healthcare-associated incident that resulted in harm to a patient). Harm was defined as impairment of structure or function of the body and/or any deleterious effect arising there from by Runciman et al. Harm includes disease, injury, suffering, disability and death [15]. Our definition of healthcare-associated harm was based on merged definitions of Markakis et al. and Gebremichael et al., and is outlined in Table 2 [7,16].

2.4. Measurements

Following a literature review, we identified risk factors regarding the patient's condition and context of transport. Based on these results, we developed a data collection form to record all relevant information on the patient's condition and context of the transport. The following risk factors were recorded: diagnoses and Modified Sequential Organ Failure Assessment (M-SOFA) score at departure, means of transport

Table 2
Criteria for healthcare-associated harm.

- death
- cardiac or respiratory arrest
- decrease in oxygen saturation >10% for more than 5 min
- airway loss requiring airway manipulation or re-intubation
- hemorrhage or blood loss estimated to be >250 ml
- cardiac arrhythmias that are associated with hemodynamic compromise or are generally accepted as requiring urgent therapy (occasional supraventricular or ventricular ectopics were not considered significant)
- hypertension (systolic blood pressure (SBP) > 200 mmHg)
- hypotension (SBP < 90 mmHg)
- neurologic deterioration (including elevation of intracranial pressure, decrease of >3 points in Glasgow Coma Scale (GCS), new fixed neurologic lesion, expanding intracranial blood collection) or transient neurological deficit
- loss of any intravascular device
- dislodgment of any thoracostomy tube, Foley catheter or surgical drain