Emergent Inter-Hospital, Direct Operating Room-to-Operating Room Transport of an Anesthetized Patient: A Case Report and Discussion

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Abstract

A 37-year-old healthy woman developed an intraoperative complication while undergoing a laparoscopic-assisted vaginal hysterectomy at a Women and Children's Hospital. Her external iliac artery was nicked, requiring emergent repair consisting of lateral wall suture-ligation to control hemorrhage. The artery was suture-ligated, and the patient was stabilized. The patient was then transferred under anesthesia to a nearby hospital equipped with a surgical intensive care unit and in-house vascular surgeon for comprehensive repair of the iliac artery. In preparation for transport, EMS was contacted, and the patient was given midazolam 2 mg IV and rocuronium 40 mg IV. An infusion of propofol 75 mcg/kg/min was administered under the supervision of an anesthesiology resident who remained with the patient during transport, and a portable mechanical ventilator provided by EMS was utilized. Standard ASA monitors were used throughout the ambulance transfer. In addition to standard emergency drugs, 2 units of packed red blood cells (pRBC), additional anesthetics (rocuronium, propofol & fentanyl), a laryngoscope and blades, an i-STAT® handheld blood analyzer, and a warming blanket were taken for transport. The patient was moved directly to the operating room upon arrival to the receiving hospital.

Keywords: emergency transport, critical care anesthesia, inter-hospital transfer, anesthesia transport guidelines, operating room-to-operating room transport.

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Introduction

The medical literature is rich with articles pertaining to the transport of critically ill patients from rural hospitals to larger, more-specialized medical centers [4,5]. These reports focus on basic transport guidelines [3,6], triaging [7], helicopter transport [8,9], and regulations [10]. Notably absent from current literature is a description of inter-hospital transport of an anesthetized patient to complete an emergency operation at a more specialized medical centre.

The incidence of inter-hospital transport of critically ill patients has increased during the past ten years [1,2]. This trend can be explained by the increasing numbers of ambulatory surgery centers located outside of urban centers, where advanced medical technology and specialized services are concentrated. Even with proper pre-operative management and careful selection of surgical candidates, unstable and life-threatening situations cannot be fully avoided. There are numerous instances of patients with unexpected complications who require transport to higher-level centers for specialized care (e.g. septic shock after elective intra-abdominal surgery, acute respiratory distress syndrome after blunt thorax trauma, lacerated artery requiring emergent graft repair). The following case outlines our approach to inter-hospital patient transport, with an emphasis on anesthetic considerations for a patient requiring emergent transfer intraoperatively due to a surgical complication.

Case Report

A 37-year-old healthy woman presented to a Hospital for Women and Children for a scheduled laparoscopic-assisted vaginal hysterectomy secondary to endometriosis and fibroids. Midazolam 1 mg IV was administered 15 minutes before the start of the case and anesthesia was induced without incident using propofol 140 mg IV. Following successful oro-tracheal intubation with direct laryngoscopy, mechanical ventilation was set, and the laparoscopic surgery proceeded as planned. After identification of the fibroid, a tenaculum was used to grasp the fibroid; however, the tenaculum clamp was noted to dislodge immediately. Upon visualization, the tooth of the clamp was noted retroperitoneally along with profuse bleeding in the left pelvis. Immediate intraoperative consult was made to a general surgeon and the case was converted to an open surgery. The general surgeon was able to identify the laceration of the left external iliac artery and repair the vessel while the gynecologist applied finger pressure to the laceration. At this time the patient was transfused with two units of packed red blood cells (pRBC's) due to blood loss estimated at 750 ml. Hemostasis was achieved and pulses were palpated above and below the repair site initially. At this point the surgery was continued with an open abdominal supracervical hysterectomy with right salpingo-oophorectomy. Upon reexamination of external iliac artery below the repair site, pulses were notably absent in the dorsalis pedis and posterior tibial artery. Biphasic doppler confirmed limited blood flow to the lower left leg and the patient was administered 5,000 units of heparin. A vascular surgeon was consulted at a specialized medical center and the surgeon agreed to accept the urgent transfer of care. Following the hysterectomy, the incision sites were closed and the patient was transported approximately 15 miles under general anesthesia for further evaluation by the vascular surgeon.

In preparation for transport, EMS was contacted, the patient was given rocuronium 40 mg IV, and midazolam 2 mg IV. An infusion of

propofol 75 mcg/kg/min was administered under the supervision of an anesthesiology resident who remained with the patient and monitored her throughout the ambulance transfer to the downtown hospital. In preparation for potential obstacles during transport, supplies were carried onto the ambulance, including four units of packed red blood cells on ice, phenylephrine, ephedrine, epinephrine, rocuronium, propofol, fentanyl, laryngoscopes and extra blades, empty syringes, an I-STAT, and a warming blanket. Additionally, there was a mechanical ventilator and standard ASA monitors provided by the EMS technicians. After arrival at the downtown hospital, handoff commenced in operating room between both anesthesia teams. Anesthesia was continued with the receiving medical team and the remainder of procedure – an interposition saphenous vein graft from the distal common iliac artery to the mid external iliac artery – commenced without incident. Postoperatively, the patient received one more unit of packed red blood cells and was transferred to the Surgical Intensive Care Unit (SICU) and eventually the floor. Post-op course was three days and unremarkable.

Discussion

The most recent guidelines for inter-hospital transport, published in Critical Care Medicine in 2004, have remained unchanged for the past decade [3]. These guidelines focus on patient transport from an emergency medicine perspective – discussing personnel, equipment and the decision to transfer. To our knowledge there exists no literature that documents patient transfer from an anesthesiologist's perspective. As noted earlier, we believe the need to transfer patients between operating rooms at different hospitals could see an upswing in the future with the centralization of specialized critical care.

The first step to inter-hospital transfer is performing a careful risk-benefit analysis of the situation. Obviously, certain life-saving surgeries can only be performed with specific equipment at a specialized medical center. However, in some cases, it may be safer from a patient perspective for a specialized surgeon to travel to the ambulatory surgery center to avoid patient transport. Before this happens though, a careful review of equipment at the ambulatory surgery needs to be evaluated. In addition, it is important to consider the post-op needs of the patient. In our case above, the decision to transport downtown was not only based on equipment but also the presence of a surgical intensive care unit at the specialized medical center where the patient could be monitored post-operatively. The hospital for women and children hospital does not contain an intensive care unit and thus the medical care team felt it was unsafe to perform the vascular repair.

In weighing the option to transfer a patient it also important to be cognizant of risks associated with transport. Although emergency transport services and equipment have improved over the past decade, the risks associated with both inter- and intra-hospital transport is well documented. The earliest study in patient transport from 1970 demonstrated arrhythmias in 84% patients transported with high-risk cardiac disease [11]. Another study in 1975 showed bleeding and hypotension in 7/33 patients undergoing intra-hospital transport [12] and a more recent study of 127 patients being transported to ICU showed mishaps (ECG lead disconnection, monitor power failure, IV disconnection, ventilator malfunction) occurring in 34% transports to ICU [13]. Wallen et al compared vital signs of patients 1 hour before transport and during transport to ICU and noted vital sign changes: most commonly blood pressure change (21.3%), heart rate change (15.7%), and hypothermia (11.2%) [14].

After determining the need to transport, the next step is acquiring the proper equipment, medications and personnel to transport the patient. The critical care guidelines for patient transport documents a list of the minimum equipment needed to transport [15]: cardiac monitor with defibrillator, airway management equipment, resuscitation bag (to allow for emergency intubation, coniotomy, and manual ventilation via mask and tube), sufficient gas supplies, battery operated infusion pump, and a portable ventilator for patients receiving mechanical ventilation. We support these recommendations with the addition of a portable clinical analyzer (e.g. i-STAT®) for rapid interpretation of electrolytes, blood gases, and blood cell counts, and warming blankets for the patient.

In terms of medications, Warren et al recommends 40 medications to be carried during emergency transport. While this list is certainly detailed, we have condensed this list to 21 essential medications to be carried by an anesthesiologist (Table 1). Considering the acute timing

Table 1 Our recommendations for anesthesia transport medications.

Warren Critical Care Guidelines [3]	Our essential anesthesia list
Adenosine, Albuterol, Amiodarone	Atropine, Dextrose (if diabetic), Diphenhydramine
Atropine, Calcium Chloride, Cetacaine/Hurricaine spray,	Ephedrine, Epinephrine, Fentanyl
Dextrose, Digoxin, Diltiazem	Glucagon (if diabetic and on insulin drip)
Diphenhydramine, Dopamine	Heparin, Labetalol, Midazolam or Lorazepam
Epinephrine, Fosphenytoin, Furosemide	Metroprolol, Morphine or Hydromorphone
Glucagon, Heparin, Isoproterenol	Normal Saline, Naloxone
Labetalol, Lidocaine, Mannitol	Nitroglycerine or Nitroprusside or Nicardipine
Magnesium Sulfate, Methyl Prednisolone	Packed RBC's (one unit per every 15 minutes of anticipated transport time)
Metoprolol, Naloxone, Nitroglycerin	Phenylephrine, Potassium Chloride
Nitroprusside, Normal Saline, Phenobarbital	Propofol or Dexmetomidine, Sodium Bicarbonate
Potassium Chloride, Procainamide, Sodium Bicarbonate	Succinylcholine
Terbutaline, Verapamil	Vecuronium or Rocuronium or Cisatracurium
To be added immediately before transport: narcotics (morphine, fentanyl), sedatives/hypnotics (lorazepam, midazolam, propofol, etomidate, ketamine), Neuromuscalar blocking (succinylcholine, rocuronium, atracurium), Prostaglandin E1, Pulmonary surfactant	

The left column is adapted from Table 1 of Warren et. al. 'Guidelines for the inter- and intrahospital transport of critically ill patients', *Critical Care Medicine*, 2004 [3]. The right column is our proposed list of essential medications needed by an anesthesia provider with the caveat that extra medications may be needed for certain comorbidities.

of such an emergency transport, we feel these 21 medications will cover a majority of situations encountered during transport under anesthesia. Additionally, we would like to make the recommendation to carry one standard 300mL packed red blood cell unit for every 15 minutes of anticipated transport in a patient at risk for blood loss.

Finally, in deciding whether an anesthesia provider is needed for direct transport of a patient under anesthesia it is important to consider limitations to EMT scope of practice. We have determined eight areas and skills where the presence of an anesthesia provider would be safer for the patient (Table 2) In reviewing current protocol for EMT delivery of medications there are a limited number of pre-approved medications that advanced EMT staff can deliver while medical direction is missing or off-line. This includes naloxone, glucose, bronchodilators using pre-measured or metered doses, epinephrine, and nitroglycerine [16]. These medications cover only a limited number of medical situations. Therefore, it is our belief that a licensed anesthesia provider should accompany patients with cardiopulmonary instability, those requiring blood products, or those with an increased risk of acute blood loss.

Table 2 Limits to EMT Scope of Practice.

Initiating or titrating infusions
Dosing mediations (EMT personnel must use auto-injectors or pre-dosed medications)
Starting blood product transfusions
Administering vasopressors (except for pre-dosed epinephrine)
Starting I.V. sedatives (i.e. midazolam)
Administering neuromuscular blocking agents
Gaining central intravenous or arterial access
Interpretation and management of blood chemistry, ABG, or ECG changes

Conclusion

Operating room-to-operating room transport of intubated patients under anesthesia carries many potential risks that may be better managed by anesthesia personnel. These events are underreported in the literature but may represent a growing trend due to the increasing number of ambulatory surgery centers and hospitals lacking specialized surgical services. We strongly recommended that a physician trained in airway management and ACLS accompany transfers of potentially unstable patients.

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