

## Focus on Selected Surgical Procedures in Prehospital Emergency Medicine

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### Editorial

In less than 60 years, medical care for undifferentiated, unscheduled patients with serious illness or injury outside hospital has developed from the stage of kinomobil the first surgeon-stuffed ambulance- to the modern Pre-Hospital Emergency Medicine (PHEM) [1]. Today, the latter is considered as a subspecialty of anesthesia or emergency medicine, a cross- point of several specialties that integrates knowledge and skills (technical or not) required to provide safe pre-hospital critical care and safe transfer [2].

The aim of this article is to focus on the surgical procedures that are now implemented in the practice of PHEM.

### Airway Management

Even though the frequency of surgical airway management is very low (some studies report 0.56%), the option remains in the Difficult Airway Society guidelines [2-5]. The available methods include surgical cricothyrotomy, needle cricothyrotomy with jet oxygenation, or percutaneous cricothyrotomy using the Seldinger technique for the adults. For children younger than 12 years, needle cricothyrotomy with percutaneous transtracheal (jet) ventilation is the surgical airway of choice [5]. Contraindications include tumour, infection or abscess at site of incision, difficulty in locating anatomical landmarks (e.g. presence of prior neck surgery, hematoma, obesity, trauma/burns or evidence or radiation therapy), distal airway obstruction and lack of operator expertise. Equipment needed is minimum; and, there are studies that report a 80% success rate in performing cricothyroidotomy even with household devices (e.g. pocket knife, ballpoint pen) [6].

The literature in favour or not of a particular method is scarce. All the three methods are considered emergency temporising procedure, and they all carry the risk of several complications, both early (e.g. bleeding, pneumothorax, posterior tracheal wall perforation, surgical emphysema, etc) and late (e.g. glottis or subglottic stenosis, dysphonia, persistent stoma, tracheoesophageal fistula). That's why they are generally considered as last-resource methods.

### Prehospital Control of Life-Threatening Haemorrhage

Haemorrhage due to trauma is the leading preventable (up to 90%) cause of death in military setting and the second most leading cause of death in trauma in the civilian setting [7]. Surgical approach may be needed at the scene for non-compressible bleeding of the trunk (e.g. intrabdominal, intrathoracic, intrapelvic) when other options are limited [8].

Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an intervention that shows promising results in patients with non-compressible haemorrhage of the torso [9]. It involves placement of an endovascular balloon in the aorta to control haemorrhage and to augment afterload in traumatic arrest and haemorrhagic shock states and it requires femoral arterial access. Contraindications include: age >70y, Pulse less electric activity (PEA) arrest (<10 minutes) secondary to exsanguination from sub-diaphragmatic haemorrhage and femoral vessels not immediately identifiable on ultrasound, cardiac arrest due to causes other than exsanguination due to severe subdiaphragmatic trauma, PEA arrest >10 minutes, high clinical/radiological suspicion of proximal traumatic aortic dissection and pre-existing terminal illness or significant comorbidities. Three Zones are identified for balloon deployment: Zone I -thoracic (left subclavian artery to coeliac artery), externally marked to xiphoid, Zone II (coeliac artery to the most caudal renal artery (approx 3 cm long) and Zone III (from the most caudal renal artery to the aortic bifurcation (approx 10 cm long), externally marked just above umbilicus. REBOA literature is still evolving and its final role is still to be defined [9-12].

Resuscitative thoracotomy (RT) is a radical intervention that enables relief of cardiac tamponade, aortic cross-clamping, pulmonary hilar clamping or twisting and internal cardiac compression [7]. Recent studies suggest that pre-hospital RT in case of penetrating trauma, more specifically stab wounds, could benefit that subcategory of patients. European Resuscitation Council (ERC) strongly recommend RT after penetrating trauma with witnessed signs of life (SoL) or ECG activity after short-term, and conditionally recommend RT in penetrating trauma without these features. In blunt trauma without witnessed SoL, RT is considered futile. Patients with

blunt trauma with vital SoL and witnessed cardiac arrest RT can be performed [13]. In the prehospital setting, RT is performed mainly via Clamshell incision (CI). Contraindication include blunt injury without witnessed cardiac activity (pre-hospital), Penetrating abdominal trauma without cardiac activity (pre-hospital), Non-traumatic cardiac arrest, severe head injury, severe multisystem injury, improperly trained team and insufficient equipment [14]. Reported survival results vary from 1.6% to 38% [13,14].

## Obstetrical Emergencies

Perimortem Caesarian Section (PMCS) or "resuscitative hysterotomy" as adopted by some authors is the surgical procedure that may be performed at prehospital setting. PMCS should be performed when the gravidic uterus is considered to be the cause of maternal hemodynamic impairment due to aorto-caval compression regardless of fetal viability. Timing is still a debating issue, yet it should be performed within 4 min after maternal cardiopulmonary resuscitation initiation. Vertical umbilical-pubic incision is preferred from the classical Pfannenstiel incision used in the in-hospital setting [15-17]. Literature is very poor about the efficiency of the procedure.

## Conclusion

As technology and medicine progresses more "surgical" procedures are integrated in the PHEM armamentarium. Even though seldom applied training and continuous education about these procedures are necessary for the prehospital emergency physician.

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