

## RESPIRATION AND AIRWAY

# Pre-hospital advanced airway management by anaesthetist and nurse anaesthetist critical care teams: a prospective observational study of 2028 pre-hospital tracheal intubations

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## Abstract

**Background:** Pre-hospital tracheal intubation success and complication rates vary considerably among provider categories. The purpose of this study was to estimate the success and complication rates of pre-hospital tracheal intubation performed by physician anaesthetist or nurse anaesthetist pre-hospital critical care teams.

**Methods:** Data were prospectively collected from critical care teams staffed with a physician anaesthetist or a nurse anaesthetist according to the Utstein template for pre-hospital advanced airway management. The patients served by six ambulance helicopters and six rapid response vehicles in Denmark, Finland, Norway, and Sweden from May 2015 to November 2016 were included.

**Results:** The critical care teams attended to 32 007 patients; 2028 (6.3%) required pre-hospital tracheal intubation. The overall success rate of pre-hospital tracheal intubation was 98.7% with a median intubation time of 25 s and an on-scene time of 25 min. The majority (67.0%) of the patients' tracheas were intubated by providers who had performed >2500 tracheal intubations. The success rate of tracheal intubation on the first attempt was 84.5%, and 95.9% of intubations were completed after two attempts. Complications related to pre-hospital tracheal intubation were recorded in 10.9% of the patients. Intubations after rapid sequence induction had a higher success rate compared with intubations without rapid sequence induction (99.4% vs 98.1%;  $P=0.02$ ). Physicians had a higher tracheal intubation success rate than nurses (99.0% vs 97.6%;  $P=0.03$ ).

**Conclusions:** When performed by experienced physician anaesthetists and nurse anaesthetists, pre-hospital tracheal intubation was completed rapidly with high success rates and a low incidence of complications.

**Clinical trial number:** NCT 02450071.

**Keywords:** airway management; emergency medical services; intubation; intratracheal

### Editor's key points

- Pre-hospital tracheal intubation is frequently difficult and can be associated with severe adverse events.
- Providers should be competent to perform the procedure and capable of preventing and treating complications.
- When performed by experienced physician anaesthetists and nurse anaesthetists, pre-hospital tracheal intubation can be completed rapidly with high success rates and a low incidence of complications.

Pre-hospital tracheal intubation is a potentially lifesaving intervention.<sup>1</sup> However, pre-hospital tracheal intubation is challenging as a result of environmental factors, patient positioning, limited airway equipment, and the availability of assistance, creating a risk of serious complications that may threaten patient safety.<sup>2–4</sup> Because tracheal intubation carries a risk of severe adverse events, providers must be both competent to perform the procedure and capable of preventing and treating complications.<sup>5,6</sup>

The success rates of pre-hospital tracheal intubation performed by emergency medical services with providers with limited or heterogeneous levels of airway expertise have been investigated in previous studies.<sup>7–10</sup> Small single-centre and single-country studies have demonstrated a high 99.7% pre-hospital tracheal intubation success rate when tracheal intubation is performed by airway experts.<sup>11</sup> However, there are no large international multicentre studies that validate these small studies or that report data only from units staffed with airway experts (i.e. anaesthetists and nurse anaesthetists). Several recently published guidelines concerning pre-hospital tracheal intubation and emergency anaesthesia recommend that these procedures be performed in accordance with the same standards as in-hospital procedures.<sup>5,12,13</sup> The guidelines emphasise that pre-hospital providers should have a skill level that would allow them to perform unsupervised

emergency tracheal intubations in the emergency department. In hospitals in the Nordic countries, all tracheal intubations are performed by physicians or nurses from the anaesthesiology and intensive care units. Physician anaesthetists and nurse anaesthetists are widely used in emergency medical services and perform the vast majority of pre-hospital tracheal intubations in the Nordic countries.<sup>14</sup> The objective of the present study was to investigate the success rate of tracheal intubation and the incidence of complications associated with tracheal intubation in a pre-hospital system in which intubation is performed only by anaesthetists and nurse anaesthetists.

## Methods

This was a prospective, observational, multicentre study of pre-hospital advanced airway management. All patients who had undergone attempted pre-hospital tracheal intubation during a primary mission by the units listed below between May 2015 and November 2016 were included in the study. A tracheal intubation attempt was defined as laryngoscopy with the intent to intubate. Tracheal intubations performed during inter-hospital missions were excluded from the study.

Ethical and institutional approvals were acquired before patient enrolment, and the study was registered at Clinicaltrials.gov (NCT02450071). Ethical review board approvals were obtained from Sweden (2015/411-31, 2015/1519-32), Denmark (Danish Data Protection Agency no. 20087-58-0035, 15/16531 and the Danish Health and Medicine Authority no. 3-3013-941/1), and Norway (2015/545/REK vest). In Finland, the study did not deviate from normal practice or documentation and consequently did not require Ethical Review Board approval.

In the Nordic countries, the national emergency medical services systems include rapid response car- and helicopter-based pre-hospital critical care teams. These teams act as a second tier of the immediate response system and are staffed by a physician anaesthetist or a nurse anaesthetist, with a few

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