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doi: 10.1093/bja/aew367

Objective description of mask ventilation

K. S. Lim* and J. R. Nielsen

Concord, Australia

*Corresponding author. E-mail: karsoonlim@gmail.com

Editor—Anaesthesia lacks a standard way to describe the outcome of mask ventilation.[1 2] This has two important consequences.

First, anaesthetists document mask ventilation poorly: description is subjective, inconsistent, and often absent.[3] Yet records of previous ease or difficulty help greatly with airway planning, because most predictions of difficulty fail—over 90% of cases are unanticipated.[4 5]

Second, difficult mask ventilation may be easy to recognize, but its definition remains subjective or overly complex.[1 2] The ASA Guidelines version requires 114 words, and lists many clinical signs and possible causes.[6]

By contrast, tracheal intubation is documented using the Cormack and Lehane scale.[7] Rather than *operator* difficulty, this scale describes a direct *patient* outcome: the best view of the patient's larynx. The ensuing record is useful for planning subsequent intubations, especially when combined with detail on how it was achieved (for example "grade 3 with Macintosh 4 blade"). Poor views at laryngoscopy (grade 3 or 4) also provide a simple and objective definition of difficult intubation.[8 9]

We propose an analogous scale for mask ventilation based on the best capnograph achieved (Fig. 1).

Grade A: plateau present
Grade B: no plateau, $ET_{CO_2} \geq 10$ mm Hg
Grade C: no plateau, $ET_{CO_2} < 10$ mm Hg
Grade D: no ET_{CO_2}

Capnography is a standard monitor which allows rapid and continuous confirmation of ventilation.[10] Our scale uses capnography to describe mask ventilation by an objective patient outcome—not operator difficulty. Check-boxes allow concurrent description of how this outcome was achieved (for example "grade B capnograph with Guedel airway").

Use of this scale does not preclude subjective comments on mask ventilation such as "easy" or "difficult", but explains and justifies them with evidence from the monitor. Scale grades simply label sequential phases of the capnograph. As ventilation

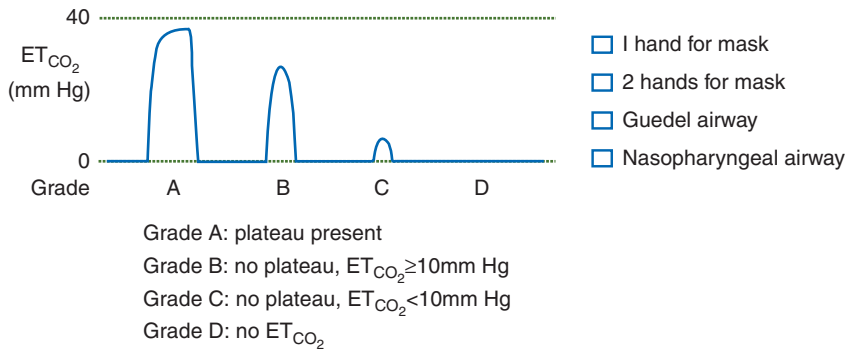

Fig 1 Proposed scale for grading mask ventilation.

improves, deadspace, mixed and then pure alveolar gas produce the flat-line, upstroke, and plateau. The plateau phase (grade A) is already recognized as a marker of effective mask ventilation.[11–13]

Grades C and D fit the ASA definition of difficult mask ventilation, which includes "inadequate or absent" exhaled CO_2.[6] For grade C, 10 mm Hg is a specific cut-off to define the word "inadequate" objectively. This value is arbitrary but precise: clinicians may never agree on what end-tidal level is inadequate, but all can be certain when the number on the monitor is below 10. In grade D there is either no ventilation or deadspace ventilation only.

Together, grades C and D can define difficult mask ventilation simply and objectively: *when the best attempt produces inadequate or no exhaled* CO_2.

We used this definition to measure the incidence of difficult mask ventilation in our teaching hospital. After ethics board approval, every episode of mask ventilation in our operating theatres was graded for three months. No anaesthetic technique was prescribed—the study was observational so that data would reflect real-world practice.

In 855 episodes, the distribution of grades was 88.4% A, 10.3% B, 1.1% C, and 0.2% D. The incidence of difficult mask ventilation (grades C and D) was 1.3%.

Previous studies of difficult mask ventilation, using various definitions, found incidences of 0.66%,[5] 0.9%,[14] 1.3%,[15] 1.4%,[16] 1.56%,[17] and 5%.[18] Although many factors affect the capnograph, such close concordance supports the clinical validity of this definition.

There is clinical utility in combining mask ventilation and laryngoscopy grades to describe the outcomes of both procedures concisely. For example, grades A-3 and A-4 would record that mask ventilation was an effective primary rescue option for a difficult intubation—and grades D-3 and D-4 would specify that it was not. This distinction is critical for airway planning.

In summary, we propose a clinical tool to describe mask ventilation based on the best capnograph achieved. Like the Cormack and Lehane scale, it is simple, objective, and grades a direct patient outcome. The scale's grades derive from basic physiology and ASA guidelines. The resulting definition of difficult mask ventilation is objective and practical, and validated by the close agreement between our incidence data and previous reports. This scale allows clinicians to describe both the technique of mask ventilation and its result. We believe this would make the anaesthetic record more clinically useful.

Conflict of interest

None declared

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doi: 10.1093/bja/aew368