Laryngoscope illuminance in a tertiary-care medical center: Industry standards & implications for quality direct laryngoscopy

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Abstract

PURPOSE: To compare illuminance of laryngoscopes in a tertiary care adult hospital to established standards, and to identify maintenance and design features associated with poor light output.

METHODS: Illuminance (lux) of laryngoscopes throughout the hospital were tested using a standard technique. Industry and literature values were used for comparison. Maintenance practices were surveyed.

RESULTS: Six hundred and ninety-one laryngoscopes were tested, including light-emitting diode (LED), incandescent bulb (on-blade), incandescent bulb (in-handle), and xenon devices. The lowest illuminance was observed for incandescent (bulb-on-blade, 820±700 lux, n=237; bulb-in-handle 1,860±1,220 lux, n=79) laryngoscopes, followed by LED (4,730±3,210 lux, n=354), and xenon source (28,800±34,500 lux, n=21). Some devices failed to turn on at all, classified as failing, (11% bulb on-blade, 6% LED). Compared to illuminance benchmarks in the medical literature (867 lux, 500 lux), 34-47% of incandescent laryngoscopes, 12% of LED laryngoscopes and 10% of xenon units did not meet quality standards for laryngoscopy. All units were cleaned by standard protocols, but no departments reported regular equipment maintenance.

CONCLUSIONS: Laryngoscopes in use at tertiary care centers may exhibit substandard illuminance. A quality-control program has begun at our institution.

Methods

Laryngoscopes throughout the hospital system were assessed (Figure 1). Illuminance (lux) was measured using a light-impermeable apparatus with a laryngoscope positioner, and light meter (Tenma, Newark Electronics, Indiana, USA; Figure 2). Illuminance data were compared to standards established in the medical literature (867 lux)\(^1\) and by the ISO (500 lux)\(^2\). Department personnel were surveyed regarding laryngoscope maintenance and sanitation practices.

Results

Laryngoscope performance and standards

Mean illuminance by laryngoscope type is reported in the Abstract. Laryngoscope outputs were compared to minimum standards reported in the literature: 867 lux (Cheung et al\(^1\)), and 500 lux (ISO\(^2\)). Units failing to turn on at all were recorded as producing 0 lux. Table 1 summarizes the results.

Maintenance practices

Surveys showed that repairs to laryngoscopes occurred in reaction to device failure. Only qualitative evaluation followed device cleaning.

Discussion

Laryngoscopes are heavily relied upon throughout all hospitals. In a tertiary care medical center, 34-47% of incandescent laryngoscopes emitted substandard light. Previous studies have found failure rates of 27-86%\(^3\). While in most cases the amount of light required to intubate an airway is less than that required for an otolaryngologist to characterize airway pathology, these rates of failure may potentially result in adverse clinical outcomes.

Subsequent to our study, new quality assurance policies specific to laryngoscopy have been instituted in our medical center, and efforts are currently underway aimed at replacing the lowest-performing population with LED style units.

Conclusion

Laryngoscopes in use at a tertiary care centers may exhibit substandard illuminance. We recommend preventive laryngoscope maintenance, including scheduled quantitative device inspection, battery or bulb replacement, and use of more efficient light sources (such as LED). This will improve laryngoscope light output, and may reduce airway-related adverse events.

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References