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Accuracy of Oxygen Flow Delivered by Compressed-Gas Cylinders in Hospital and Prehospital Emergency Care

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Abstract

BACKGROUND: Oxygen cylinders are widely used both in hospital and prehospital care. Excessive or inappropriate $\mathbf{F}_{IO_2}$ may be critical for patients with hypercapnia or hypoxia. Moreover, over-oxygenation could be deleterious in ischemic disorders. Supplemental oxygen from oxygen cylinder should therefore be delivered accurately. The aim of this study was to assess the accuracy of oxygen flows for oxygen cylinder in

hospital and prehospital care.

METHODS: A prospective trial was conducted to evaluate accuracy of delivered oxygen flows (2, 4, 6, 9 and 12 L/min) for different oxygen cylinder ready for use in different hospital departments. Delivered flows were analyzed randomly using a calibrated thermal mass flow meter. Two types of oxygen cylinder were evaluated: 78 oxygen cylinder with a single-stage regulator and 70 oxygen cylinder with a dual-stage regulator. Delivered flows were compared to the required oxygen flow. The residual pressure value for each oxygen cylinder was considered. A coefficient of variation was calculated to compare the variability of the delivered flow between the two types of oxygen cylinder.

RESULTS: The median values of delivered flows were all ≥ 100% of the required flow for single stage (range 100–109%) and < 100% of required flow for dual stage (range 95–97%). The median values of the delivered flow differed between single and dual stage. It was found that single stage is significantly higher than dual stage ($P < .01$). At low flow, the dispersion of the measures for single stage was higher than with a high oxygen flow. Delivered flow differences were also found between low and high residual pressures, but only with single stage ($P < .02$). The residual pressure for both oxygen cylinders (no. = 148) ranged from 73 to 2,900 pounds per square inch, and no significant difference was observed between the 2 types ($P = .86$). The calculated coefficient of variation ranged from 7% (±1%) for dual stage to 8% (±2%) for single stage.

CONCLUSIONS: This study shows good accuracy of oxygen flow delivered via oxygen cylinders. This accuracy was higher with dual stage. Single stage was also accurate, however, at low flow this accuracy is slightly less. Moreover, with single stage, when residual pressure decreases, the median value of delivered flow decreased.

oxygen gas cylinders | oxygen therapy | accuracy | hyperoxia | hypoxia

Footnotes

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- The authors have disclosed no conflicts of interest.

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