

GAS MAN VERSION 4.1 TEACHES INHALATION KINETICS

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Introduction: Gas Man® version 4.1 computer simulation of inhalation anesthesia uptake and distribution was completed in 2011 after 27 years of evolution.^{1,2} Inhaled anesthetics are part of most anesthetics given around the world, and their evolving use makes understanding this subject important to all anesthesiologists.

Objectives: We sought to determine if Gas Man Version 4.1 teaches relevant aspects of inhalation kinetics.

Methods: We reviewed the Gas Man Workbook and Program that teaches inhalation anesthesia kinetics. Gas Man program runs on all modern Microsoft and Apple operating systems and conforms to the latest graphical user interface customs. The C++ program is compiled to platform-specific software using QT (Nokia, Finland). It is written in English and has been translated into Chinese and an earlier version was translated into French.

Results: Earlier versions of Gas Man that were shown to be accurate³, educationally valid⁴, and able to teach important clinical subjects.⁵ The Gas Man Workbook of version 4.1 is a course in inhalation anesthesia kinetics that guides the user through exercises that demonstrate aspects of inhalation anesthesia kinetics through interaction and visualization. Beginning Workbook chapters teach single-compartment wash-in and the alveolar tension curve including initial rise, plateau, knee and tail. Later chapters teach routine and advanced clinical techniques. Vaporizer overpressure and brief high fresh gas flow quickly change anesthetic depth. Multiple agents interact with concentration effect and second-gas effect. Open, semi-closed, closed, and ideal breathing circuits perform differently. Low fresh gas flow can reduce cost. Displaying quantity of drug delivered from vaporizer and taken up by patient demonstrates efficiency and waste. Changing body weight shows kinetic differences between children and adults.

Users can demonstrate many interactions. Vital Capacity Induction can be achieved in less than one minute using a breathing circuit primed with anesthetic agent. Hyperventilation and reduced cardiac output increases anesthesia depth and causes overdose with soluble agents. Hypoventilation after emergence leads to reanesthetization if muscle tissue has achieved 1 MAC anesthetic tension.

During 2011 Gas Man 4.1 was used for CME courses in inhalation kinetics for over 600 anesthesiologists in India and 1000 anesthesiologists in China (Chinese version).

Discussion: Gas Man version 4.1 appears to be capable of teaching inhalation anesthesia kinetics and is appropriate for use in developing and developed countries. Creating a group of teachers who can teach other teachers appears warranted.

Conclusion: Gas Man Version 4.1 functions effectively as an educational tool on all modern computer platforms and in 2011 was used in CME courses to teach over 1600 anesthesiologists in India and China inhalation anesthesia kinetics including identifying inspired, expired and brain anesthetic agent tensions.

Potential Conflicts: Gas Man and Med Man Simulations, Inc., is a nonprofit charitable organization as 501(c)(3) certified by the US Government. James H Philip is the author of the program and workbook. Dr. James Philip and Dr. Beverly Philip received honoraria for teaching some of the Gas Man courses.

References

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