

Geriatric Patients: Pharmacology Differences

Anesthetic Pearls: The Pharmacologic Differences of Geriatric Patients

BACKGROUND

In geriatric patients there is a decrease in total body water that results in a decreased volume of distribution (and therefore a higher plasma concentration) for water-soluble drugs. An increase in body fat leads to a higher volume of distribution (and a lower plasma concentration) of lipid-soluble drugs. However, there is also a slower inter-compartmental redistribution of drugs from the central compartment to circulation, resulting in a higher plasma concentration of drug at a lower dose when compared to younger patients. Renal and hepatic function are decreased which leads to a prolongation of elimination half-lives and duration of action for drugs dependent upon renal and hepatic clearance.

INHALATIONAL AGENTS

The minimal alveolar concentration (MAC) for volatile anesthetics is reduced (by as much as 30% from young adult values) and parallels a decrease in brain neurotransmitter activity. Age-dependent depression of cardiac output will lead to a faster onset of action; while such onset will be delayed by V/Q mismatch caused by deterioration of alveolar architecture and increased FRC due to loss of the elastic recoil of the lung. The myocardial depressant effects of volatile anesthetics are exaggerated in elderly patients, while the tachycardic tendencies of isoflurane and enflurane are attenuated.

INTRAVENOUS AGENTS

As discussed above, a smaller central compartment to plasma volume, combined with a decreased rate of inter-compartmental redistribution results in higher plasma concentrations of drug after an initial IV bolus. This accounts for the decreased dose needed to achieve a specific plasma concentration of drug, and therefore the decreased induction dose needed for drugs such as thiopental and propofol, although the actual sensitivity of the brain to these drugs does not change. However, the IV dose of midazolam required to produce sedation is dramatically decreased secondary to a pharmacodynamic difference in intrinsic brain sensitivity to midazolam between young and elderly patients (independent of any pharmacokinetic differences). There appears to be an increase in the elderly patient's inherent sensitivity to opioid drugs, thereby reducing the dosage requirements of these agents. The dosages of fentanyl and alfentanil are reduced by as much as 50% compared to equivalent dosages for middle aged persons.

MUSCLE RELAXANTS

There is an intrinsic sensitivity of the neuromuscular junction to muscle relaxant drugs does not change with aging, but decreased cardiac output and slow muscle blood perfusion may delay the onset of neuromuscular blockade. Prolonged clearance of pancuronium, doxacurium, tubocurarine, and metocurine results from a reduction in renal function. Decreased hepatic clearance may result in a prolongation of the elimination half-life and duration of action of vecuronium and rocuronium. Ester hydrolysis and Hoffman elimination are not affected by aging and therefore the duration of action of atracurium and cisatracurium are NOT affected.