

Aspects of Mechanical Ventilation Affecting Interatrial Shunt Flow During General Anesthesia

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Abstract

Intraoperative transesophageal echocardiography was used to study the incidence of flow-patent foramen ovale in 33 normal, healthy patients (ASA physical status I) undergoing general anesthesia in the supine position for nonthoracic surgical procedures. Echocardiographic contrast was injected intravenously during mechanical ventilation in the presence of 0, 5, 10, 15, or 19 cm H₂O positive end-expiratory pressure (PEEP). A final test was performed during the release of 19 cm H₂O PEEP. The presence of a flow-patent foramen ovale was detected when the injected echo targets were observed crossing the interatrial septum from right to left. Most interesting, 3 of 33 patients developed a right-to-left shunt that was first detected with the steady application of 10 (1 patient) or 15 cm H₂O PEEP (2 patients). In all three cases, the shunt flow was accentuated on the release of PEEP; however, no additional cases were detected using this respiratory maneuver. These cases represent the first demonstration of right-to-left interatrial shunting evoked as the result of the sustained application of PEEP. This study also revealed a lower than expected incidence of flow-patent foramen ovale (9%) when measured during general anesthesia and positive pressure ventilation with or without PEEP.