expiration. It would be interesting to know if the absolute gastric pressure was different before and after operation or before and after drug therapy, since abdominal muscle activity could account for some of the observations. The work that the authors quote with regard to abdominal muscle activity is in patients with respiratory failure and is hardly relevant to their own observations. The influence of aminophylline seems to have been to alter the change in gastric pressure during inspiration from -1 to +1.2 cmH₂O.

This could have been partly the result of a change in the pattern of abdominal muscle action, for example, a reduction in tonic activity (spasm due to pain) or a loss of expiratory activity. In another circumstance, we have found a decrease in Pga on inspiration, in patients breathing spontaneously during anesthesia, of the same order of magnitude. We attributed this to expiratory abdominal muscle activity.² However, it is clear that if ΔPpl does not change, and ΔPga increases, that ΔPdi will increase, indicating a more forceful contraction of the diaphragm. This would be expected from the known actions of aminophylline. However, changes in Pga depend on the extent of use of the abdominal and rib-cage muscles as well as the diaphragm, and, unless an attempt is made to assess the action of these muscle groups, the pressure data presented cannot be reliably interpreted as an indication of an action on the diaphragm alone.

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In reply: Dr. Drummond is questioning the change in the difference between gastric pressure at end-inspiration and gastric pressure during inspiration (ΔPga) as a reliable parameter to assess the contribution of the diaphragm to quiet breathing. He suggests that abdominal muscle contraction may occur after upper abdominal surgery and could influence ΔPga. According to his comment, changes in absolute gastric pressure (Pga) would be a better index to reflect the expiratory abdominal muscle activity. Although, negative changes in Pga during inspiration might be related to expiratory relaxation of abdominal muscles, Pga also can be altered by other factors such as pneumoperitoneum. Few data regarding abdominal muscle activity after upper abdominal surgery are available at this time, and it may be questionable to compare respiratory muscle activity occurring during general anesthesia¹ with that after upper abdominal surgery. In addition, absence of abdominal muscle contraction after upper abdominal surgery was reported by Simmoneau et al.² in patients developing negative ΔPga.

As stated by Ford et al.³ any reduction in ΔPga after upper abdominal surgery, without any change in pleural pressure (ΔPpl), indicated a decrease in diaphragmatic contribution to tidal volume. Conversely, any increase in ΔPga, without change in ΔPpl, indicates an increased contribution of the diaphragm to breathing. Therefore, during quiet tidal breathing, ΔPpl determines tidal volume, whereas any contribution from the diaphragm is directly reflected by ΔPga. Thus, we can conclude that an increase in the ratio of ΔPga to transdiaphragmatic pressure (ΔPdi) is well related to the effects of aminophylline on the diaphragm alone.

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