TITLE: USE OF A HEAT AND MOISTURE EXCHANGER PARTIALLY IMPROVES THE CORRELATION BETWEEN ESOPHAGEAL AND CORE TEMPERATURE

AUTHORS: M.N. Siegel, M.D., N. Gravenstein, M.D.

AFFILIATIONS: Departments of Anesthesiology and Neurosurgery, University of Florida College of Medicine, Gainesville, Florida 32610

Introduction. Recently, temperature probes have been incorporated into esophageal stethoscopes. Unfortunately, because of the temperature gradient along the length of the esophagus, the site most efficient for auscultation (i.e., the site where both heart and lung sounds are most audible, called "best sounds") does not produce the most clinically useful temperature (i.e., the temperature most closely resembling that in the heart and brain) (1). One factor that influences esophageal temperature, but does not affect the measurement of core temperature, is the temperature of inspired gases. This study determined the effects of warming of inspired gases with a passive heat and moisture exchanger (HME) on the correlation of esophageal and nasopharyngeal temperatures (i.e., core temperature).

Materials and Methods. After institutional approval, 15 adult patients undergoing general anesthesia with endotracheal intubation and mechanical ventilation were studied. After intubation, an 18-Fr esophageal stethoscope with a temperature sensor located within the hollow tip of the stethoscope (Mallinckrodt Hi-Lo) was inserted. The position of the esophageal stethoscope was adjusted to achieve acceptable heart and breath sounds. The probe was attached to a monitor. A second temperature probe was placed trans-nasally into the nasopharynx to a depth approximating the external auditory meatus surface landmark. The positions of the esophageal and nasopharyngeal probes did not change during the study. For each patient, 20 min for equilibration of temperature was allowed before recording esophageal and nasopharyngeal temperatures. An HME (Engstrom Edith 1000) was attached to the endotracheal tube. After a second 20-min period of equilibration, nasopharyngeal and esophageal temperatures were again recorded. These measurements were repeated following equilibration periods. During two measurements the HME was in place, and during two measurements it was not. Statistical analysis consisted of ANOVA and paired t-test.

Results. The differences in initial temperatures measured at the nasopharyngeal mucosa and the esophagus ranged from 0.5-1.4°C before placement of the HME (mean difference, 0.9°C; $P < 0.001$) (Fig.). After placement of the HME, esophageal temperatures increased significantly ($P < 0.001$), the mean increase being 0.5°C (range, 0.2-1.2°C). In contrast, nasopharyngeal temperatures did not change significantly. Despite the increase in esophageal temperatures, the mean difference between nasopharyngeal and esophageal temperatures (0.4°C) was still significant ($P < 0.001$).

Discussion. In this study, we compared nasopharyngeal temperature with esophageal temperature at the site of "best sounds." We measured temperatures before and after addition of an HME, an in-line device that passively warms and humidifies inspired gases. Although we warmed the trachea (and thus the retrotracheal esophagus) to above baseline, nasopharyngeal and esophageal temperatures still differed significantly. Because this difference was as high as 1.4°C, the clinician should consider obtaining a better estimate of core temperature, perhaps by temporarily inserting the esophageal stethoscope an additional 12-16 cm so that the temperature probe lies retrocardiac, before diagnosing hypothermia and instituting active warming measures. Resolution of the discrepancies in body temperature obtained by esophageal stethoscope temperature probes placed at the site of "best sounds" and those obtained from the nasopharynx await an esophageal stethoscope temperature probe that can be placed reliably in the retrocardiac esophagus.

References.

1. Kaufman RD: Relationship between esophageal temperature gradient and heart and lung sounds heard by esophageal stethoscope. Anesth Analg 66:1046-1048, 1987

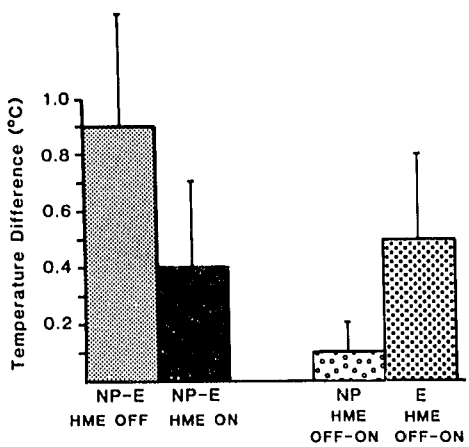

Fig. Mean (± SD) values for nasopharyngeal (NP) and esophageal (E) temperatures measured by a temperature probe located in the tip of an esophageal stethoscope. The first two columns show the differences in temperatures (between the two sites) occurring before and after addition of a heat and moisture exchanger (HME) to the endotracheal tube ("HME off" and "HME on"). The second two columns show the results, for each site, when temperature before use of an HME was compared with temperature during its use.