TITLE: COMPARISON OF CRYSTALLINE SKIN TEMPERATURE TO ESOPHAGEAL TEMPERATURES DURING ANESTHESIA

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Introduction. Although liquid crystal thermometry has been in use for over a decade, most investigators have not found it sufficiently accurate to be used as an indicator of core temperature intraoperatively.[1] The present study sought to compare a new type of crystalline temperature indicator (CT) to esophageal temperature (ET) monitoring when a circuit gas warmer is not used during general anesthesia.

Methods. Following institutional IRB approval, CT and ET were compared in 127 patients undergoing general anesthesia for a variety of surgical procedures. After intubation, an ET probe was placed per usual clinical practice. A CT strip (Sharn, Tampa, FL) was then placed on the patient's forehead. ET and CT temperatures were recorded at 10 minute intervals for 90 minutes. Mean temperature differences (in °F) at each time point as well as temperature variations over time were compared using Wilcoxon signed rank test. Data are presented as mean ± SD, median and 5th-95th percentile, with $p<0.05$ considered statistically significant.

Results. The mean ET-CT differences at each time point consistently were <0.30°F (Table 1). This suggested a close relationship between the two temperature monitoring devices. (p=ns for comparisons at each 10-minute time point.) As noted in Table 2, the mean change in ET temperature between 5 and 45 minutes (ET_{5-45}) was 0.02°F, while the corresponding change for CT (CT_{5-45}) was -0.05°F (p = ns). Similar consistency was noted for ET_{45-85} and CT_{45-85}.

Discussion. The data suggest that new crystalline temperature devices correlate highly with esophageal temperatures. The mean ET and CT at each time point were within 0.3°F. Moreover, the two monitoring techniques trended similarly, as evidenced by the consistency of the ET-CT differences over time. It appears that CT would constitute a suitable means of monitoring temperature trends. CT indicators may also be preferable if circuit warmers were used during clinical anesthesia, as esophageal probe accuracy could be influenced by the temperature of the inhaled gases. However, the consistency suggested by the present data should be confirmed in the context of major cardiothoracic surgery and other settings which are characterized by rapid temperature changes.

TABLE 1

Time	Mean±SD	Median	5-95th %ile
5 (min)	-0.23±1.4	-0.3	-2.5 to 2.1
15 (min)	-0.29±1.5	-0.4	-2.5 to 2.4
25 (min)	-0.30±1.5	-0.4	-2.5 to 2.2
35 (min)	-0.22±1.5	-0.3	-2.5 to 2.3
45 (min)	-0.30±1.5	-0.5	-2.4 to 2.3
55 (min)	-0.21±1.6	-0.3	-2.6 to 2.4
65 (min)	-0.26±1.6	-0.4	-2.8 to 2.6
75 (min)	-0.27±1.6	-0.5	-2.6 to 2.6
85 (min)	-0.26±1.6	-0.5	-2.7 to 3.0

TABLE 2

	Mean ± SD	Median	5-95th %ile
ET_{5-45}	0.02±0.9	0.0	-1.5 to 1.2
CT_{5-45}	-0.05±1.3	0.0	-2.6 to 1.8
$ET-CT_{5-45}$	0.07±1.4	0.0	-2.0 to 2.8
ET_{45-85}	-0.01±0.7	0.0	-1.1 to 1.0
CT_{45-85}	0.04±1.1	0.0	-2.0 to 2.0
$ET-CT_{45-85}$	-0.04±1.0	0.0	-1.7 to 1.7

Reference:
1. Anaesthesia 39:54-56, 1984

TITLE: RELIABILITY OF FEF END-TIDAL CO_2 DETECTOR DURING CPR

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FEF end-tidal CO_2 detector has been suggested to be able to identify an esophageal intubation. Its portability gives it an important advantage over the mass spectrometer and infra-red CO_2 analyzers during CPR and in areas where the latter are not available. The aim of this study was to determine the reliability of FEF end-tidal CO_2 detector during CPR.

Method: With approval of the institutional animal investigation committee, six Yorkshire swine were anesthetized with ketamine 15-20 mg/kg i.m. Following loss of consciousness, anesthesia was maintained with pentobarbital 20 mg/kg/hr i.v. The animals were mechanically ventilated at 15 mg/kg at a rate of 10 per min. with an endotracheal tube (7.0 mm) placed through a tracheostomy. Ventricular fibrillation was induced with 20 ml. of KCL i.v. CPR was done with chest compression at a rate of 60-70 per min. Adequacy of CPR was assessed by maintaining mean arterial pressure in range of 30-35 mm of Hg. End-tidal CO_2 and color change in FEF CO_2 detector were recorded continuously prior to and during CPR. The spectrum in the color chart provided (by the manufacturer) indicates A-tube in esophagus, B-uncertain, C-tube in trachea.

Results: The end tidal CO_2 and color spectrum prior to and during CPR are shown in the table. In five animals out of six, the FEF CO_2 detector was unable to confirm correct placement of endotracheal tube.

Animal No.	End-Tidal CO_2 (%)		Color Spectrum in FEF Detector	
	Prior to CPR	During CPR	Prior to CPR	During CPR
1	6.3	0	C	A
2	5.7	1.8	C	C
3	4.5	1.0	C	B
4	4.3	1.3	C	B
5	4.1	1.3	C	B
6	4.2	1.0	C	B

Discussion: End-tidal CO_2 values are affected by ventilation, perfusion and CO_2 production. During CPR, low cardiac output would decrease end-tidal CO_2 levels. CO_2 levels of similar magnitude have been recorded with six esophageal ventilations.[1] This study indicates FEF end-tidal CO_2 detector may not be able to differentiate tracheal from esophageal intubation during the first six ventilations.

Reference:
1. Anesth Analg 69:627-32;1989.