Electrodermal Activity Monitoring during Endotracheal Suction in Sedated Adult Intensive Care Unit Patients

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Background: Endotracheal suctioning of respiratory secretions is one of the most common causes of pain and discomfort in Intensive Care Unit environment. The electrical properties of the skin, also known as electrodermal activity (EDA), are considered as an indirect measure of autonomous nervous system.

Aim: This study explores EDA changes during endotracheal suction in sedated adult critical care patients; and compares these changes to other monitoring parameters.

Materials and methods: Skin conductance variability, selected hemodynamic and respiratory parameters, bispectral index (BIS) and ambient noise level, were monitored during 4 hour routine daytime intensive care nursing and treatment in an adult Intensive Care Unit. 4h-measurements were divided into 2 groups, based upon the sedation level (group A: Ramsay sedation scale 2-4 and group B: 5-6 respectively) of the patients. Selected recordings before and after endotracheal suction (stress events) were performed. Seven stress events from Group A and 17 from Group B were included for further analysis. Patients’ demographics, laboratory exams and severity scores were recorded. Pain status evaluation before every event was also performed via 2 independent observers.

Results: In both groups the rate of EDA changes was greater than in other monitoring parameters. Yet, in group A only selected parameters were significantly changed after the start of the procedure, while in group B, every parameter showed significant change (p<0.05). Groups were similar for other co-founding factors.

Conclusion: EDA measurements are more sensitive to stress stimuli, than cardiovascular, respiratory or even BIS monitoring. Deeper sedation seems to affect more the intensity of EDA changes during suction.

BACKGROUND

Endotracheal suctioning of respiratory secretions is one of the most common procedures applied in Intensive Care Unit (ICU) environment.¹ Even though procedural guidelines for endotracheal suction have been developed²-⁴, several local practice protocols are often used⁵-⁶. Low evidence of the existent guidelines is suggested as the reason for such discrepancy.⁵

In any way, endotracheal suction is unanimously recognized as one of the commonest causes of pain and stress during ICU hospitalization.⁷,⁸ Therefore, measuring the effect of this particular stimulus is an important issue. Available literature is characterized by a diversity of studies’ focuses. Some measure the effect of different types of suctioning (open or closed) via behavioral pain (BPS) or agitation scales⁹, some measure the effect of different type of applied negative pressure on heart rate and oxygen saturation¹⁰ and others the effect of the depth of suctioning (swallow or deep) to deferent cardiovascular indices¹¹-¹². Recently, there have been a few
reports about monitoring stress/pain during endotra-
chael suctioning via measuring selected lab markers
(serum beta-endorphin and salivary alpha-amylase
levels)\(^{13}\), pain scales such as BPS\(^{14}\), COMFORT
sedation score\(^{13}\), facial action coding system\(^{14}\) or
pupils’ dynamics (digital pupillometry)\(^{15}\).

Electrodermal activity (EDA) originates in the
activation of sweat glands in response to stress
or other stimuli and thought to reflect the activity
of the sympathetic nervous system, or physiologi-
cal arousal.\(^ {16} \) Though it has been studied since 19th
century, the first report about application of EDA
monitoring in perioperative setting was published
in 2002.\(^ {17,18} \) Yet, the vast majority of literature is
coming for operation room setting or post anæsthe-
sia unit care and perioperative EDA measurements
have been used mainly as analgesia index.\(^ {17} \) Only
recently, there are reports about EDA measurements
in adult\(^ {19,20} \) or pediætric ICU environment\(^ {17,21}\).
Thus, the overall data are scarce.

Till the writing of the present article, EDA
monitoring during endotracheal suction have been
applied only in pediatric ICU population, with in-
teresting results: when applied in children between
1-11 years old, the number of skin conductance
fluctuations seems to be an objective supplement to
the modified COMFORT sedation score for moni-
toring increased stress in artificially ventilated and
circulatory stable children.\(^ {22-23} \) In neonatal intensive
care the measurement of conductivity of the skin is
an objective tool to measure pain and discomfort
during invasive procedures despite the use of seda-
tion and analgesia.\(^ {23} \)

The aim of the study was to measure EDA
changes due to endotracheal suction stimulation in
adult ICU patients under sedation, and to compare
these changes with cardiovascular/respiratory effects
of the same stress (suction) stimulus.

MATERIALS AND METHODS

This prospective observational study was conducted
at the adult general ICU, at AHEPA General Uni-
versity Hospital, Thessaloniki, Greece. Twenty five
(25) measurements in critically ill patients under
sedation, above 18 years old, were included in the
study. Other inclusion criteria were administered
mechanical ventilation > 24 h and constant seda-
tion level under midazolam or propofol continuous
intravenous infusion (c.i.v.). On the contrary, patients
with Ramsay sedation score (RSS) 1, diagnosed or
with history of hearing problems, psychiatric dis-
orders, neurological diseases, neuro- or myopathy,
delirium, CNS or spinal cord injury, were excluded.
Also as exclusion criteria were considered pregnancy,
hemodynamic/respiratory instability, edema of the
upper limbs (place of measurement) and the presence
of sensitive electrical life-sustainable devices such
as cardiac pace, renal replacement therapy devices,
intra-abdominal aortal counterpulsion pump, extra-
corporal membrane oxygenation and artificial liver.

Skin conductance (SC) variability, selected hemo-
dynamic and respiratory parameters were monitored
during 4 hour routine daytime intensive care nurs-
ing and treatment. Measurements were divided into
2 categories according to patients’ sedation level:
group A – RSS 2-4 (\(n_a=10\)) and group B – RAS
5-6 (\(n_b=15\)).

Med Storm Pain Monitor System (MED Storm®
Innovation AS, Oslo, Norway) was used as SC
monitor.\(^ {24} \) Three single use Ag/Cl electrodes were
attached at the palmar surface of the hand: on the
thenar eminence (current), on the hypothenar emi-
nence (measurement) and just below 2\(^ \text{nd}\) and 3\(^ \text{rd}\)
digits (reference). In order to minimize artifacts, the
hand least likely to move, with no intravenous or
intra-arterial lines was chosen. SC was measured by
alternating current of 66 Hz and an applied voltage
of 50 mV. SC parameters recorded were: absolute SC
(in \(\mu\)S), peaks/sec or number of SC fluctuations per
second (NSCF), the average peak (micro Siemens
seconds – \(\mu\)Ss), the rate of increase or decrease from
the start to the end of the measurement window (rise
time, in micro Siemens per second - \(\mu\)S/s), area
huge peaks (\(\mu\)Ss), area small peaks (\(\mu\)Ss) and
the larger of the two measures (referred as area under
curve - AUC, in \(\mu\)Ss). Cut off for NSCF counting
was >0.005, much more sensitive than the >0.02
\(\mu\)S used in relative pain monitoring literature.\(^ {20} \)
Signal quality <80% was considered artifact and
the measurement was also excluded.

Measurement window of interest was 60 sec and
60 sec after endotracheal suction, provided that 4
min before and 1 min. after the stimulus there was
no other stimulus of any kind (i.e. venepuncture).
In order to ensure the observational character of
the study, and to waive any possible ethical con-
siderations, suction stimulation (referred as suction
‘event’) was product of the daily nursing/treatment
routing inside ICU environment and not artificial
deliberately-created stimulus. The characteristics of
the suctions included were: open, deep, with duration
of 10-12 sec, applied negative pressure of 100 mmHg
and no use of NaCl 0.9\%.\(^ {2,4} \) Endotracheal suctions
with different characteristics (e.g. closed, swallow)
were not included. Pre-procedural analgesia was not routinely given. Five minutes before and during the procedure, pain was assessed via Critical Care Observation Pain Tool (CPOT) by two independent observers. If CPOT score > 3 (by both observers) pre-procedural analgesia was administered and the measurements were excluded from further analysis.

Only those suction ‘events’ that were within the aforementioned frames, were included for further analysis (in total 24 for both groups).

The rest of the parameters were monitored via Bedside Monitor BSM 9101K and Monitor CNS 9601 (Nihon Kohden® Ltd., Japan), and included: heart rate (HR), systolic (SAP), diastolic (DAP) and mean arterial pressure (MAP), number of ventricular premature contractions (VPC), electocardiographic ST wave deviation in II lead (ST II) and respiratory rate (RR). Since the above were used in the literature as possible measures of stress, recordings were used as measure of comparison with SC parameters.

In selected measurements (group A: 4, group B: 12) bispectral index monitor (BIS) (Covidien®, USA) was also in place.

Ambient noise level was measured at a distance of 30 cm from the head of the patient via Sound Level Meter GM13656 (Shenzhen Jumaoyuan Science & Technology® Co., China)

Data analysis was performed with MS Office Excel 2007 (Microsoft® Co, USA) and Rstudio IDE® v.1.00.136. (Rstudio Inc, USA)

Descriptive statistics are presented as weighted average (x̅), standard deviation (s), 1st and 3rd quartile (Q1 and Q3 respectively) and range (min-max). Two comparison designs were applied: one examined acute changes before/after the noise stimulus and one that examined the range of change between the two groups. Shapiro-Francia or (Shapiro-Wilk for BIS) normality test was performed for the parameters of interest and then paired Student t-test or Wilcoxon signed ranked test was calculated. Results were presented as p value (Confidence Interval – CI). Statistical significance for p is set at p<0.05 and CI level at 95%. CPOT score is presented as X(s), while agreement between the two observers were evaluated with inter-rater reliability (IRR) and Lin concordance correlation coefficient ρc (with two-sided 95% Confidence Limits-CL). Finally, true positive value of parameters with statistical significant change (p<0.05) to spot stress event (we arbitrary used the 25% change as a cut-off value for each parameter) was calculated, i.e. if a stress event causes at least 25% change in the value of the parameter of interest, what is the sensitivity of each parameter to ‘spot’ a stress event?

RESULTS

General characteristics of patients in each group of measurements are shown in Table 1. Different averages of APACHE II score, Extended Glasgow Outcome Score (GOSE) and PaO₂/FiO₂ can partially account for the different sedation level. All measurements were conducted on white Caucasian patients. Ambient noise levels, 4 min before the start of the procedure were: 57.53 (4.75) dB in group A and 56.54 (2.62) dB in group B. Hemoglobin and serum electrolytes were within normal limits for both groups.

During recording time, 7 suction ‘events’ occurred in group A (4 had also BIS monitor) and 17 in group B (12 had also BIS monitor) that met inclusion criteria for further analysis. Main descriptive statistics before and after stimulus, for the two groups, is displayed in Table 2 and Table 3, respectively.

The mean percentage of change before/after the ‘event’ (endotracheal suction) is also shown in Table 4, which demonstrates the vast amount of EDA parameters change.

Table 1. General characteristics of the patients included finally in each group

|                  | Group A | Group B | APACHE II | Group A | Group B |
|------------------|---------|---------|-----------|---------|---------|
| N measurement    | 10      | 15      | 15.4 (1.55) | 19.6 (1.66) |
| Sex              | ♂=10, ♀=0 | ♂=9, ♀=6 | SOFA 6.3 (0.9) | 7.9 (0.4) |
| Age (years)      | 66.5 (14.8) | 63.8 (10.9) | GOSE 6.4 (0.9) | 5.2 (0.8) |
| Weight (kg)      | 90.6 (15.1) | 89.95 (12.6) | t (°C) 37.2 (0.3) | 37.1 (0.4) |
| BMI( kg/m²)      | 28 (1.65) | 30.3 (0.85) | PaO₂ / FiO₂ 294 (69.3) | 230 (81.8) |

Presented form: mean (SD), rounded to the nearest decimal. SOFA: Sequential Organ Failure Assessment (SOFA) Score
Table 2. Main descriptive statistics and before/after comparison of the measurements during suction in 1st group sedation level

| Group | Parameter → statistic | HR (bpm) | VPC (no) | STII | SAP (mmHg) | MAP (mmHg) |
|-------|-----------------------|----------|----------|-------|-------------|-------------|
| Before | x (s)  | 70.3(12.55) | 0.142(0.378) | 0.02(0.037) | 121(19.96) | 80.14(12.75) |
|      | Q1,Q3 | 63.5,77 | 0,0 | 0.05,0.045 | 113,118 | 71,88 |
|      | Range | 50-88 | 0-1 | -0.05-6 | 108-166 | 68-102 |
| After  | x (s) | 73.5(11.35) | 0.857(0.899) | 0.214(0.034) | 144.1(32.87) | 93(26.66) |
|      | Q1,Q3 | 67,82 | 0,1 | 0.05,0.045 | 124.5,145.5 | 75.5,101 |
|      | Range | 56-86 | 0-2 | -0.05-0.07 | 116-214 | 67-144 |
|      | p | 0.097+ | 0.173* | 0.355+ | 0.022+ | 0.62* |
|      | CI [95%] | [-7.37,0.8] | NA | [-0.004,0.02] | [-38.5,-8] | [-26.8,6.2] |

| Parameter → statistic | DAP (mmHg) | RR (br/min) | BIS (n=4) | ArHP (μSs) | ArSP (μSs) |
|-----------------------|------------|-------------|------------|-------------|-------------|
| Before | x (s) | 59(11.46) | 14.71(2.56) | 40.25(39.97) | 0.088(0.166) | 0.027(0.072) |
|      | Q1,Q3 | 50,69 | 13,16.5 | 35.25,47.5 | 0.095 | 0 |
|      | Range | 48-75 | 11-18 | 24-52 | -0.43 | 0-0.19 |
| After  | x (s) | 75.14(19.58) | 15.43(3.49) | 63(11.73) | 2.94(3.1) | 0.104(0.132) |
|      | Q1,Q3 | 60.5,89 | 13,17.5 | 54.72,5 | 0.59 | 0.016 |
|      | Range | 48-101 | 11-21 | 33-92 | 0-6.62 | 0-0.35 |
|      | p | 0.039+ | 0.182+ | 0.082+ | 0.1 | 0.1* |
|      | CI [95%] | [-31.2,-1] | [-1.8,0.4] | [-50.8,5.3] | [-6.6,-2.1] | [-0.19,-0.05] |

| Parameter → statistic | NFSC (μSs) | AvRT | AvP | AUC (μSs) | SC (μS) |
|-----------------------|------------|------|-----|----------|--------|
| Before | x (s) | 0.023(0.035) | 0(0) | 0.005(0.005) | 0.088(0.166) | 4.878(2.598) |
|      | Q1,Q3 | 0.02,0 | 0,0 | 0,01 | 0,095 | 3.719,5.108 |
|      | Range | 0-0.1 | NA | 0-0.01 | 0-0.43 | 1.919-10.211 |
| After  | x (s) | 0.083(0.08) | 0(0) | 0.03(0.04) | 2.94(3.09) | 4.928(2.62) |
|      | Q1,Q3 | 0.02,0.135 | 0,0 | 0.01,0.015 | 0.025,5,9 | 3.802,5,167 |
|      | Range | 0.02-0.22 | NA | 0.01-0.14 | 0-6.62 | 1.921-10.292 |
|      | p | 0.02* | NA | 0.88* | 0.59* | 0.086+ |
|      | CI [95%] | [-0.13,-0.01] | NA | NA | [-6,-2.1] | [-7.7,1.4] |

+ Students paired t-test
* Wilcoxon signed ranked test with continuity correction (paired)

The 95% confidence interval is providing the range of the difference of the means falls in, with (1-a=0.05) % confidence. In cases that zero in included then we can’t rule out the possibility that the means are equal, up to a 1 in 20 chance of having missed a difference.

HR-heart rate, VPC - ventricular premature contractions (number), STII - electrocardiographic ST wave deviation in II lead, SAP - systolic arterial pressure, MAP - mean arterial pressure, DAP - diastolic arterial pressure, RR - respiratory rate, BIS-Bi-spectral index value and EDA parameters (ArHP, ArSP, NFSC, AvRT, AvP, AUC, SC)
Table 3. Main descriptive statistics and before/after comparison of the measurements during suction in 2nd group sedation level

| Group       | Parameter → statistic | Before | After | P          | CI [95%]  |
|-------------|-----------------------|--------|-------|------------|-----------|
|             | HR (bpm)              | x̅(s)  | 78.78(17.17) | 81.71(18.04) | 0.028+    | [-6.8,-0.6] | [-10.2,-2.8] |
| B (RSS 5-6), n=17 | VPC (no)              | Q1,Q3  | 67,83 | 70,96      | 0.711*    | [-1.5,0.5]  | [-4.1,-0.25] |
|             | STII                  | Range  | 56-112| 56-113     | 0.671*    | [-0.01,0.01] | [-36.5,-17] |
|             | SAP (mmHg)            | x̅(s)  | 0.823(3.39) | 0.942(2.9)  | 0.0001+   | [-19.2,-7.5] | [-39.8,-2.3] |
|             | MAP (mmHg)            | Q1,Q3  | 0.0 | 0.0 | 0.03*    | [-0.03,-0.01] | [-1.47,-0.06] |
|             | DAP (mmHg)            | Range  | 56-112| 56-113     | 0.001*    | [0.01,0.01]  | [0.01,0.01]  |
|             | RR (br/min)           | x̅(s)  | 13.06(2.88) | 15.24(3.96) | 0.029+    | [-0.03,-0.01] | [-0.21,-0.001] |
|             | BIS (n=12)            | Q1,Q3  | 51,65 | 58,70      | 0.025*    | [-0.21,-0.001] | [-39.8,-2.3] |
|             | ArHP (μSs)            | Range  | 12,14 | 14,17      | 0.03*     | [2.05,0.17]  | [4.78,0.31]  |
|             | ArSP (μSs)            | x̅(s)  | 47.82(12.44) | 74.27(13.07) | 0.005+    | [-0.36,-0.01] | [-36.5,-17]  |
|             | NFSC (μSs)            | Q1,Q3  | 13.06(2.88) | 15.24(3.96) | 0.029+    | [-0.03,-0.01] | [-0.21,-0.001] |
|             | AvRT                  | Range  | 0.007 | 0.007      | 0.03*     | [2.05,0.17]  | [4.78,0.31]  |
|             | AvP                   | x̅(s)  | 0.03(0.063) | 0.14(0.286) | 0.003*    | [-0.03,-0.01] | [-0.21,-0.001] |
|             | AUC (μSs)             | Q1,Q3  | 0.03(0.063) | 0.14(0.286) | 0.03*     | [-0.1,0.07]  | [-0.21,-0.001] |
|             | SC (μS)               | Range  | 2.737(6.54) | 3.878(92.73) | 0.003*    | [-0.36,-0.01] | [-0.21,-0.001] |
|             |                      | x̅(s)  | 7.026(5.09) | 7.757(5.765) | 0.001*    | [2.05,0.17]  | [4.78,0.31]  |

+ Students paired t-test
* Wilcoxon signed ranked test with continuity correction (paired)

The 95% confidence interval is providing the range of the difference of the means falls in, with (1-a=0.05) % confidence. In cases that zero in included then we can’t rule out the possibility that the means are equal, up to a 1 in 20 chance of having missed a difference.

HR - heart rate, VPC - ventricular premature contractions (number), STII - electrocardiographic ST wave deviation in II lead, SAP - systolic arterial pressure, MAP - mean arterial pressure, DAP - diastolic arterial pressure, RR - respiratory rate, BIS - Bi-spectral index value and EDA parameters (ArHP, ArSP, NFSC, AvRT, AvP, AUC, SC)
Table 4. Mean change (%) for every measured parameter

| % A     | HR  | VPC | STII | SAP  | MAP  | DAP  |
|---------|-----|-----|------|------|------|------|
| Group A | 5.226 | 2.77 | 17.81 | 14.44 | 28.247 |
| Group B | 4.622 | -29.64 | 11.13 | 14.22 | 11.67 |

| % A     | RR  | BIS | SPL  | SVV  | ArHP |
|---------|-----|-----|------|------|------|
| Group A | 4.06 | 56  | 8.35 | 81.66 | >2113.4 |
| Group B | 20.01 | 61.28 | 13.91 | 41.85 | >3804.6 |

| % A     | ArSP NFSC AvRT AvP AUC SC |
|---------|--------------------------|
| Group A | 84.21 330 25 >2113.4 1.03 200 |
| Group B | 191.06 111.88 449.2 >5638.62 8.91 240 |

Table 5. Agreement of the two observes of the CPOT recordings

| Parameter | IRR* (%) | ρc ** | ρc CL 95% | IRR* (%) | ρc ** | ρc CL 95% |
|-----------|----------|--------|-----------|----------|--------|-----------|
| Before    | 85.71    | 0.59   | [-0.11,0.89] | 76.47    | 0.84   | [0.64,0.93] |
| After     | 85.72    | 0.96   | [0.85,0.99]  | 88.23    | 0.98   | [0.96,0.99] |

*Inter rater reliability
**Lin concordance correlation coefficient (with two-sided 95% Confidence Limits)

Table 6. True positive rate of parameters to spot ‘stress’ event (see Materials and Methods for explanations)

| Parameter | SAP  | DAP  | NFSC |
|-----------|------|------|------|
| TPR       | 0.29 | 0.43 | 0.47 |

| Parameter | SAP  | MAP  | DAP  |
|-----------|------|------|------|
| TPR       | 0.00 | 0.06 | 0.12 |

| Parameter | RR  | BIS* | ArHP |
|-----------|-----|------|------|
| TPR       | 0.35 | 0.75 | 0.94 |

| Parameter | NFSC | AvRT | AvP  | AUC |
|-----------|------|------|------|-----|
| TPR       | 0.88 | 1.00 | 0.82 | 0.94 |

| Parameter | SC  |
|-----------|-----|
| TPR       | 0.12 |
CPOT score before was 0.143 (0.377) for both observers in group A; while in group B it was 0.4 (0.79) and 0.64 (0.93) for 1st and 2nd observer, respectively. During the ‘event’ the scores were: 2 (1.73) and 2.43 (1.57) for group A and 2 (2.18) and 2 (2.09) for group B. Agreement of the 2 observers are presented in Table 5.

Finally, the true positive rate of selected monitoring parameters is displayed as $\bar{x} \ [95\% \ CI]$ in Table 6.

DISCUSSION

The results illustrate some interesting findings. In both groups the rate of EDA changes are much greater than any other monitoring parameters used. Yet, in cases with lighter sedation level (group A), only SAP, DAP and NFSC are significantly changed after the start of the procedure. On the contrary when measurements occurred in patients with deeper level of sedation (group B), almost every measured parameter shows significant change. In the same group, the sensitivity of EDA parameters, to spot stress events (defined as stimulus that could cause at least 25% change of the monitoring parameter) was only comparable to BIS.

The differences between the two groups may have several explanations. The authors assume that, since the patients in group A were in position of knowing that endotracheal suction is about to take place; the stimulus itself had lower stress ‘load’; and this was reflected in the measurements. Apart from that, though the criteria for including the measurements of a procedure were relatively strict, performing suction to more awake patients may have affected the procedure itself in ways others than those predefined by the authors (open, deep, etc).

Electrodermal measures in ambulatory setting may vary with individual differences in age, race, and BMI. Yet, in the present study, both groups were similar both in age, weight and BMI. All measurements were conducted on white Caucasian patients; hence any racial effects on EDA were also absent. Noise is also a recognized stress stimulus in ICU, and EDA measurements are affected from ICU noise stimuli. Yet, ambient noise before the start of the procedure was similar in both groups. The same is true for main laboratory parameters. Sex may play a confounding role in EDA measurement because of monthly hormonal variations in women. However, the measurements in the present study were conducted in older women. In addition, laboratory studies in ambulatory setting have been inconclusive.

Sleep quality has been connected in the literature with several diseases. Thus, quality of sleep between the two groups is possible contributing factor; however it was not evaluated in the current study.

Also, endotracheal suction could be treated as a complex ‘package’ of several other stimuli, like e.g. pain, agitation, and noise. Moreover, each of them may possess its own characteristics (e.g. intensity, duration, frequency for noise). The present study did not analyze the possible contribution of each of them in the final recordings.

The relatively small number of measurements and the open, observational character of the study can also be considered as limitations. Further studies in bigger samples both in ‘stable’ and unstable ICU patients, probably with more predefined stimuli are needed in order to have a clear idea of the role of EDA monitoring in adult ICU environment. The use of adequate analgesia and the type of sedative agent (e.g. propofol or dexmedetomidine) is a prospective that needs to be assessed. The reports from pediatric patients may suggest EDA monitor as an analgesia monitor; but even these are few.

Finally, the exact role and physiological ‘reflection’ of every one of the aforementioned EDA parameters to the ANS activity is yet to be determined.

CONCLUSION

EDA measurements are more sensitive to endotracheal suction in sedated adult ICU patients than cardiovascular, respiratory or even BIS monitoring; thus serving as a more sensitive index of stimulus-induced stress. However, future studies are needed in order to define EDA role as stress monitor and to clarify possible specific stimulus EDA response patterns in all group of ICU patients.

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ETHICS

The study is part of a thesis project, approved by AHEPA General University Hospital Research Committee and by No 16/09-07-2013 General Assembly of Special Composition of Medical School, Aristotle University of Thessaloniki (Ref. No.8220/10-07-2013).
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CONFLICT OF INTEREST
All authors declare no conflict of interest.

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Мониторинг электродермальной активности во время эндотрахеального выделения респираторных секретов у седированных пациентов пожилого возраста из отделения интенсивной терапии

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Введение: Эндотрахеальное выделение респираторных секретов является одной из наиболее часто встречающихся причин проявления боли и недомогания во время интенсивной терапии. Электрические свойства кожи, известные под именем электродермальная активность (ЭДА), принято считать проявлением косвенной оценки вегетативной нервной системы.

Цель: Данное исследование прослеживает изменения в ЭДА во время эндотрахеального выделения секретов у седированных пациентов пожилого возраста и сопоставляет установленные изменения с другими показателями мониторинга.

Методы: Изменчивость проводимости кожи, выбранные гемодинамические и респираторные параметры, биспектральный индекс (BIS) и уровень окружающего шума были мониторированы в течение четырехчасового сестринского ухода в отделении интенсивной терапии и лечения в отделении интенсивной терапии для пожилых больных. Четырехчасовые измерения были распределены в две группы в зависимости от уровня седации (группа A: в пределах 2 – 4 по шкале Рамзи и группа B: соответственно в пределах 5 – 6) больных. Были осуществлены выборочные измерения до и после эндотрахеального выделения (стрессовые ситуации). Семь из стрессовых
ситуаций из группы А и 17 из группы Б были отобраны для дополнительного анализа. Были зафиксированы демографические данные, лабораторные исследования и оценка тяжести состояния. Также была осуществлена оценка боли до наступления каждой ситуации двумя независимыми наблюдателями.

Результаты: И в обеих группах показатели изменений ЭДА являются более высокими по сравнению с другими прослеживаемыми параметрами. Независимо от этого, в группе А только выбранные параметры показали основательные изменения, а в группе Б каждый из параметров показывает основательное изменение (p<0.05). В группах установлены аналогичные результаты в отношении других сопутствующих факторов.

Заключение: Измерения ЭДА проявляют большую степень чувствительности на стрессовые раздражители по сравнению с сердечно-сосудистым, респираторным или даже BIS мониторингом. Состояние глубокой седации по всей вероятности оказывает более сильное воздействие на интенсивность изменения ЭДА во время выделения респираторных секретов.