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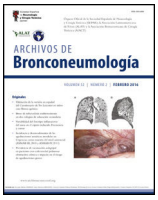

Scientific Letter

Poor Monitor Screen Height Positioning by Pulmonologists During Flexible Bronchoscopy: A Nested, Prospective Observational Trial

Colocación de la pantalla del monitor a una altura inadecuada por los neumólogos durante la broncoscopia flexible: un estudio observacional prospectivo anidado

Dear Editor,

Healthcare providers performing endoscopic procedures are at risk for poor ergonomic positioning and musculoskeletal strain/injury for numerous reasons, likely related to repetitive, forceful, and prolonged maneuvers.[1,2] Limited literature suggests that musculoskeletal pain related to endoscopy[3–7] is indeed a phenomenon, but the etiologies generally remain undiscovered. It is likely many factors play a role in modifying ergonomics within the bronchoscopy suite. Monitor screens and positioning providing some impact and represent a potentially easily correctable solution. Important literature from video-assisted surgery describes optimum monitor position being at least 1 meter from the surgeon's eyes with slight declination (0–15°) from a neutral gaze height.[8,9] There remains minimal data reflecting the role this may play within bronchoscopy and/or the ergonomic impact monitor height may play during bronchoscopy. We sought to prospectively observe the monitor height selected by bronchoscopists during a randomized trial of ergonomics related to bronchoscope design.

A prospective trial of different bronchoscopy designs was performed on a low-fidelity simulation bronchoscopy mannequin and has previously been reported.[10] Within this trial, additional data regarding monitor height during bronchoscopy was collected. As previously described, bronchoscopies were performed on a mannequin utilizing an adjustable-height, standard-sized patient gurney, targeting three pre-defined areas. All bronchoscopies were performed from the head of the bed with the video monitor located toward the foot of the bed on adjustable ceiling mounted boom monitors. All subjects were verbally prompted to adjust the height of the gurney and the monitor to their personal preference prior to each bronchoscopic examination. Subjects were otherwise encouraged to perform bronchoscopy as they typically would perform in their clinical practice.

Subject height measurement was obtained prior to testing for the day with eye height calculated from anthropometric averages.[11] Monitor and bed height were obtained immediately prior to each bronchoscopy with no additional feedback offered to the subjects performing bronchoscopy. Monitor height remained untouched and unadjusted by study staff. Suggested monitor height was calculated from each subjects measured body height with a 10° declination of gaze and used as the reference height for their monitor height. All procedures and data collection were performed within the endoscopy suite (IRB Approval – IRB00063334).

All data was de-identified, collected and stored within the REDCap[12] database system. Baseline demographics are described using means, standard deviations and percentages. All analysis of data was performed using Excel (Microsoft, Redmond, WA).

A total of 13 subjects were enrolled within the trial, with each subject performing six separate bronchoscopies, thus providing a total of 78 bronchoscopic exams. Measurements were available for all subjects and bronchoscopy procedures. The mean age of the group was 41.3 (SD 12.9) years with seven males and six females. The mean height of participants was 174.5 (SD 11.68, range 157.5–195.6) cm and the mean body mass index was 24.6 (SD 4.0) kg/m^2. During bronchoscopy procedures, the suggested monitor height was incorrect (inclined and above eye line of site) in 89.7% (70/78) of the time (Fig. 1A). Prior to each bronchoscopy, monitor height was adjusted by bronchoscopists only 17.9% (14/78) of the time, with four of the thirteen (30.8%) bronchoscopists never changing the monitor height during their entire testing period. Only five of the thirteen bronchoscopists maintained persistent screen height during their six bronchoscopy procedures, however only one bronchoscopist had an average appropriate screen height (Fig. 1B).

This study of bronchoscopy related ergonomics remains an exciting one, in particular with the little data published to date. We report somewhat disturbing data on the likely poor ergonomic practices of bronchoscopists during multiple simulated bronchoscopies. Our data suggest that bronchoscopists, despite verbal prompting otherwise, often elect to leave monitor heights unchanged prior to initiation of bronchoscopy and also with the vast majority electing to utilize poorly positioned monitor heights. The most striking abnormality is the apparent preference of an inclined monitor height for bronchoscopy and that many bronchoscopists utilized monitor heights that varied between bronchoscopic procedures. Previous work in ergonomics (including video monitor use during surgery) suggests that the ideal gaze direction should be in the 10–15° downward plane, leading us to conclude that many of our observed bronchoscopists place themselves in poor ergonomic position during bronchoscopy.

It remains unclear as to the basis for our observation of poor ergonomic positioning, highlighting the need for further study to help identify etiologies for poor ergonomic positioning of equipment during bronchoscopic procedures. One of the most likely theories for this observation includes physician education/awareness. It also appears that this may be one of the potentially easiest interventions to help remediate this problem. While many physicians are likely "aware" of ergonomics related to their daily activities, it remains unclear as to how aware they may be when performing specific activities that have a high risk of ergonomically impacting them. A limitation of our study was that we did not query our subjects on their perception of ergonomics prior to initiating the study. Additional limitations of our study include the small sample size, and the fact that it was nested within another prospective trial, however we believed this would be an

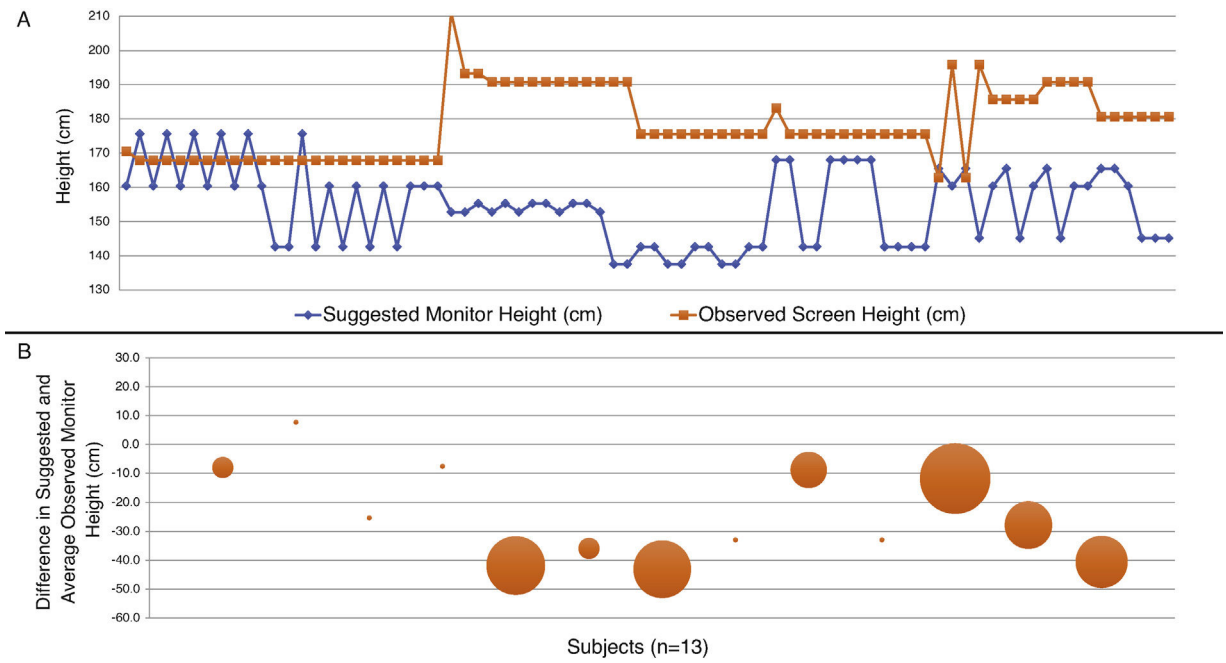

Fig. 1. Graphical and pictorial representation of suggested monitor height versus observed monitor height. (A) Graphical display of all 78 bronchoscopies with the suggested monitor height displayed in one line (■) against the observed monitor height in one line (■). (B) Graphical display of the difference in suggested and average observed monitor heights by subjects ($n = 13$). Smaller sized dots represent a smaller average difference between the suggested and observed monitor height, consistent with monitor heights that remain similar for each of the six bronchoscopies performed by the subject. Larger dots represent a larger average difference between the suggested and observed monitor height, consistent with varying monitor heights for each of the six bronchoscopies performed by the subject. The presence of a negative number indicates a higher average observed monitor height than suggested by their body height, consistent with poor ergonomic positioning.

opportune time to prospectively collect data on bronchoscopists within a controlled and reproducible environment. Strengths of this study include its prospective data collection and the wide range of subjects in regards to age, gender, and height. The use of a fully mobile, ceiling mounted video monitor also adds strength to this project as any height/modification could be easily accommodated. We also purposefully prompted each bronchoscopist to make them aware of the potential to modify monitor height each time they were performing bronchoscopy.

In conclusion we present a novel report on the disturbing observation of poor ergonomic positioning of monitor height during bronchoscopy. We hope this report serves as an overall warning and educational opportunity to bronchoscopists (and potentially other endoscopists) regarding potential interventions that can improve ergonomics. We also hope this report will prompt additional research within this oft neglected topic.

Authors Contributions

CRG, JT, AC, NJP, ACA, ADL, HJL, and LBY all contributed to study design, data acquisition, and analysis, drafting of the manuscript, final approval of the manuscript. All authors agree to be accountable for all aspects of the final submitted manuscript.

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Attitudes and Perceptions Surrounding Arterial Puncture for Blood Gas Testing: Differences Between Nurses in the Emergency Department and the Pulmonology Department☆

Actitudes y percepciones frente a la técnica de punción arterial para gasometría: diferencias entre enfermeras de los servicios de urgencias y de neumología

Dear Editor,

Guidelines have been published to provide protocols standardizing clinical activity and procedures in direct puncture arterial blood collection for the determination of arterial blood gases (ABG).[1,2] However, some earlier studies[3] and clinical experience seem to indicate that the techniques used by professionals still vary and that guidelines for the performance of this procedure are not always followed, especially those aimed at reducing pain caused by the procedure.

In this article we aim to explore and compare attitudes and perceptions surrounding the arterial puncture technique for determining ABG in adults among nursing professionals in the pulmonology and emergency departments of several third-level hospitals in the Basque Country (Spain).

A cross-sectional analytical study was conducted using a voluntary, anonymous survey of active nursing professionals from 4 hospital emergency departments (ED) and 5 pulmonology inpatient departments (PID) from 5 third-level hospitals in the Basque Country, with a staff of 285 emergency nurses and 79 pulmonology nurses.

The survey was prepared *ad hoc* by the researchers, using other previous studies as a model.[3,4] Content validation was performed sequentially by way of a review of the initial questionnaire by the researchers, a critical analysis by a group of experts, and a pilot survey completed by 10 nursing professionals to verify adequate understanding by the study subjects. The final questionnaire comprised a section of social and vocational variables and a series of questions centered on self-perception/self-evaluation of different attitudes toward the technique, using open- and closed-ended questions and descriptive rating scales.

The questionnaire was distributed between January and February 2020 by institutional email among the nursing staff who were working at the time in the units selected for study. A reminder was sent 15 days after the initial invitation.

Categorical variables are expressed as absolute frequencies and percentages. To test the hypothesis, the X^2 test or Fisher test with a 2-tailed significance level of 95% (P<.05) was applied. The magnitude of the association with the effect variable "no local anesthesia used" according to different covariables was evaluated by crude calculation of the odds ratio (OR) and 95% confidence interval (95% CI). Data analysis was performed using SPSS 25 and OpenEpi 3.01.

A total of 185 nurses from EDs and 58 from PIDs participated in the survey (65.9% participation rate). Table 1 describes the main characteristics of the respondents and their responses to questions on their attitudes and perceptions regarding the ABG technique.

While the Allen maneuver is rare in both departments, the use of strategies to control iatrogenic pain was significantly higher in PIDs, where the proportion of nurses who believe that the systematic use of local anesthesia is recommendable is also higher. However, there were no differences between departments in nurses' perception of pain caused by the procedure: 73.7% of respondents estimated that the puncture generated more than 4 points on the 0–10-point NRS-11 numeric pain scale.

The factors most strongly associated with the non-routine use of anesthesia were not knowing other colleagues in their department who used it (OR 66.7; 95% CI 22.2–273.8); performing ABG in the ED (OR 28.2; 95% CI 13.1–63.8); perception of iatrogenic puncture pain less than or equal to 4 points on the NRS11 scale (OR 3.6; 95% CI 1.5–9.7), and high or very high self-perceived arterial puncture skill by the professionals themselves (OR 2.3; 95% CI 1.2–4.5).

The use of the Allen test as a screening method for deficits in palmar collateral circulation is described in most of the reference guides,[1,2] but this maneuver is highly controversial, and some authors have advised against it.[5]

There is some scientific consensus that any pain scoring more than 3 points on the NRS11 scale should be treated.[6] In the case of ABG, the pain generated by the technique is evaluated by the patients at between 2 and 5 points and, while differences emerge depending on the difficulty of the procedure,[7–9] it is widely agreed that the use of measures to mitigate iatrogenic pain should be evaluated. Local injection of mepi/lidocaine is the most common practice used to mitigate this type of pain,[10,11] but it is rarely applied in EDs.

The reason for poor adherence to anesthesia most often given is the perception that the routine injection of mepi/lidocaine at the site of arterial puncture offers no therapeutic advantage. Indeed, although clinical guidelines advocate its systematic administration, the scientific evidence in this regard is inconclusive[12] and some authors currently propose as an alternative the use of selective anesthesia based on criteria of patient preference, professional expertise, and technical difficulty of the puncture.[13] In our study, we observed that nurses who considered themselves expert or who felt that the pain caused by their punctures was less than 4 points on the NRS11 scale were more reluctant to use anesthesia on a regular basis.

The lack of time available to apply anesthesia (attributed to high demand for care or emergency situations) has also been highlighted as an argument for omitting anesthetic treatment. The emergency situation is the main contraindication for anesthesia use during ABG procedures, but patients who attend EDs and who are classified with triage levels higher than II on the Manchester scale should

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