Arch Bronconeumol. 2020;56(8):526–539

Sociedad Española de Neumología y Cirugía Torácica SEPAR

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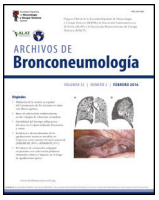

Scientific Letter

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

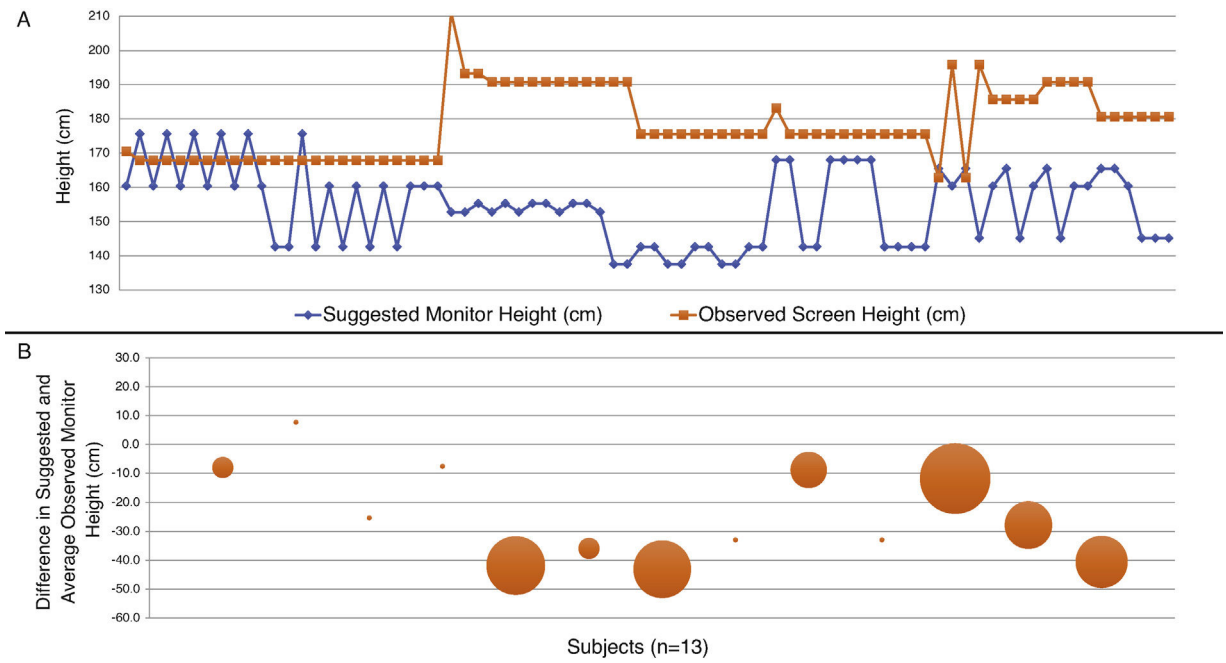

Fig. 1. Graphical and pictorial representation of suggested monitor height versus observed monitor height. (A) Graphical display of all 78 bronchoscopies with the suggested monitor height displayed in one line (■) against the observed monitor height in one line (■). (B) Graphical display of the difference 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.

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 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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https://doi.org/10.1016/j.arbres.2020.03.008

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

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

Estimado Director:

Con la visión de estandarizar la actividad clínica, existen guías de procedimiento que normalizan el proceso de extracción de sangre arterial por punción directa para gasometría[1,2], aunque algunos estudios previos[3], así como la experiencia clínica parecen indicar que aún existe una variabilidad técnica entre profesionales y que no siempre se siguen las directrices para la realización de este procedimiento, especialmente aquellas orientadas a la disminución del dolor iatrogénico derivado de la realización de la prueba.

El objetivo de este trabajo se centra en explorar y comparar las actitudes y percepciones frente a la técnica de punción arterial para gasometría en paciente adulto entre los profesionales de enfermería de las unidades de hospitalización de neumología y de urgencias de varios hospitales de tercer nivel del País Vasco (España).

Se realizó un estudio analítico transversal basado en una encuesta voluntaria y anónima dirigida a profesionales de enfermería en activo de cuatro servicios de urgencias hospitalarias (SUH) y cinco servicios de hospitalización de neumología (SHN) de cinco hospitales de tercer nivel del País Vasco, lo que suponía una plantilla de 285 enfermeras de urgencias y 79 de neumología.

La encuesta fue elaborada *ad hoc* por los investigadores tomando como modelo otros estudios previos[3,4]. La validación de contenido se realizó de forma secuencial, mediante la revisión del cuestionario inicial por parte de los investigadores, un análisis crítico por un grupo de expertos y mediante la realización de una piloto sobre 10 profesionales de enfermería para verificar la adecuada comprensión por parte de los sujetos objeto de estudio. El cuestionario final quedó constituido por un apartado de variables socio-laborales y una serie de preguntas organizadas en torno a la autopercepción/autoevaluación de diferentes actitudes frente a la técnica, empleando preguntas de respuesta abierta y cerrada y escalas de estimación descriptivas.

La difusión de la encuesta entre la plantilla de enfermería que en ese momento componía las unidades objeto de estudio se realizó entre enero y febrero de 2020 a través del correo electrónico institucional, realizando un recordatorio a los 15 días de la invitación inicial.

Las variables categóricas se expresan en frecuencias absolutas y porcentajes. Para el contraste de hipótesis se aplicó el test de X^2 o test de Fisher, considerándose un nivel de significación bilateral de 95% ($p < 0,05$). La magnitud de la asociación a la variable efecto «no utilización de anestesia local» en función de diferentes covariables se evaluó mediante el cálculo crudo de la Odds Ratio (OR) y su intervalo de confianza al 95% (IC95%). El análisis de datos se realizó mediante SPSS 25 y OpenEpi 3.01.

Participaron en la encuesta 185 enfermeras de los SUH y 58 de los SHN (tasa de participación del 65,9%). La tabla 1 describe las principales características de los encuestados y las respuestas sobre sus actitudes y percepciones frente a la técnica de gasometría arterial.

Aunque la realización de la maniobra de Allen es poco habitual en ambos servicios, la aplicación de estrategias de control del dolor iatrogénico es notablemente superior en los SHN, donde también resulta superior la proporción de enfermeras que consideran recomendable el uso sistemático de anestesia local. Sin embargo, no se apreciaron diferencias entre unidades en la percepción por parte de los profesionales del dolor iatrogénico derivado de la técnica, donde el 73,7% de los encuestados estimaron que la punción generaba un valor superior a 4 puntos en una escala numérica de dolor de 0-10 puntos -NRS11-.

Los factores más fuertemente asociados al no uso de anestesia de forma rutinaria fueron el hecho de no conocer a otros colegas de su servicio que la utilizasen (OR 66,7; IC95% 22,2-273,8); realizar la gasometría en el SUH (OR 28,2; IC95% 13,1-63,8); una percepción por parte de la enfermera del dolor iatrogénico derivado de la punción inferior o igual a 4 puntos en la escala NRS11 (OR 3,6; IC95% 1,5-9,7) y una destreza técnica en punción arterial alta o muy alta autopercibida por el propio profesional (OR 2,3; IC95% 1,2-4,5).

El uso del test de Allen como método de cribado de déficits en la circulación colateral palmar, si bien está descrita en la mayor parte de las guías de referencia[1,2], es una maniobra con fuerte controversia, habiendo sido desaconsejada por algunos autores[5].

Por otro lado, existe cierto consenso científico al determinar que cualquier dolor con una valoración superior a 3 puntos en la escala NRS11 es tributario de tratamiento[6]. En el caso de la gasometría arterial, se ha constatado que el dolor que la técnica genera es evaluado por los pacientes entre 2 y 5 puntos y, aunque existen diferencias en función de la dificultad del procedimiento[7-9], la valoración del empleo de medidas orientadas a mitigar el dolor iatrogénico ha sido una demanda generalizada. La inyección local de mepi/lidocaína constituye la práctica más estandarizada para mitigar el dolor por esta causa[10,11], pero es escasamente aplicada en los SUH.

La razón mayoritariamente aducida para justificar la escasa adhesión a la anestesia ha sido la percepción de que la inyección rutinaria de mepi/lidocaína en el lugar de punción arterial no supone una ventaja terapéutica; y es que, a pesar de que las guías clínicas abogan por su administración sistemática, la evidencia científica al respecto tampoco es concluyente[12] y en la actualidad, algunos autores han propuesto como alternativa la anestesia selectiva en base a criterios de preferencias del paciente, pericia del profesional y dificultad técnica de la punción[13]. De hecho, en nuestra muestra se ha observado que aquellas enfermeras que se consideraron expertas o que percibían que el dolor producido por