

Activity-Based Checks (ABCs) of Pain: A Functional Pain Scale Used by Surgical Patients

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ABSTRACT

Introduction. Increased rates of surgery, combined with concerns about high-risk pain medications, have highlighted the need for improved methods of meaningfully assessing pain. In response to lack of medical context and functional data in existing scales, the Activity-Based Checks (ABCs) was developed.

Methods. This prospective, cohort study was deployed at a single-institution, academic center. The primary outcome was to correlate the ABCs to the 0 - 10 numeric rating scale (NRS) in post-operative general surgery patients. Secondary outcomes included assessing the impact of patient factors and prescribing patterns on opioid consumption, in milligrams of morphine equivalents (MME), after discharge.

Results. The function that correlated most to the NRS at discharge was “Out of Bed to Chair”. Indicators of better mental health were correlated inversely with MME consumption. Interestingly, the largest predictor of MME taken was MME prescribed. Over 40% of prescribed opioids goes unused.

Conclusions. Functional pain scales, like the ABCs, may be useful adjuncts to evaluate pain. Individual functions, such as, “Out of Bed to Chair”, may be of particular importance. Clinicians must be aware that the strongest predictor of MMEs taken by patients was MMEs prescribed, highlighting the importance of better pain assessments and opioid stewardship. *Kans J Med* 2022;15:82-85

INTRODUCTION

In the United States, 48 million surgical inpatient procedures were performed in 2010.¹ Most, if not all, resulted in some form of pain. As the rate of surgical procedures grows annually, postsurgical pain and treatment are increasingly important and there is a need for evidence-based standards for pain management. This includes assessments of clinically relevant pain that can guide treatment to avoid undertreatment, as well as overtreatment, of pain. The latter is critical given the expanding use and availability of analgesics, especially opioids, and associated concerns about their overuse or abuse.

Current proven methods of assessment are lacking, with prior studies showing that clinicians frequently are frustrated by both poor pain assessment and lack of knowledge about pain.² There have been numerous efforts to develop better pain scales.^{3,4} In addition to the commonly utilized 0 - 10 pain scale, assessments such as the pain visual analog scale (VAS), numeric rating 0 - 10 scale (NRS), and the Wong-Baker (FACES) scale have been studied. These scales are all linear and unidimensional. Their greatest utility is that they allow for quick assessment of pain intensity. However, their applications to clinical care are limited by a lack of medical context and functional data. Without

functional indicators or other anchors, pain measurement is highly variable making the connection between pain assessment and prescription patterns unpredictable.⁵

In response to this need for a functionally relevant pain assessment, the Activity Based Checks of Pain - Functional Pain Scale (ABCs) was developed. The ABCs is a novel functional pain scale that links pain to functional activities deemed important in the recovery period. This prospective observational cohort study deployed ABCs in a perioperative setting with patients undergoing general surgical procedures, such as breast/epigastric flap surgeries, laparoscopic abdominal surgeries, lymph node dissections, and head and neck procedures, including thyroidectomies and parathyroidectomies. The primary objective was to compare the ABCs scale to the 0 - 10 NRS. The secondary objective compared the impact of patient and provider factors on medication usage and prescribing patterns.

METHODS

Overview. This study was a prospective, observational study comparing scores for the ABCs of Pain against those of the NRS pain scale. It was approved by the Institutional Review Board at the University of Kansas Medical Center.

Patient Cohort. This study was conducted in an urban, academic hospital. Patients between the ages of 18 and 80, who were scheduled to undergo thyroid/parathyroidectomies, local wide excisions, and other general abdominal surgical procedures, were considered for inclusion in this study. Exclusion criteria consisted of Eastern Cooperative Oncology Group (ECOG) performance status of ≥ 3 at baseline, known pain disorders or history of pain medication abuse, dementia or neurocognitive disorders, diagnosis of depression or anxiety, or if patients were unable or unwilling to provide accurate pill counts of outpatient pain medications used as required by study protocol.

Scale Formation. To establish face validity, a convenience sample of clinical faculty of the general surgery (n = 3), urologic surgery (n = 2), orthopedic surgery (n = 1), and otolaryngology departments (n = 4) assembled to determine post-operative priorities regarding functional recovery. Two authors developed the visual representation of the scale. It then was approved by the surgical faculty (Figure 1). The included functional activities increase in difficulty as the scale descends. Scoring is scaled to reflect the increased functional demands of each activity. Horizontally, a score is recorded for the pain experienced performing the corresponding functional activity, given that they are able to perform that activity. For the purposes of data analysis, the columns are assigned an ordinal number from 0 to 5. For example, “no pain” is scored a zero and “new worst pain” is scored a five. The “old worst pain” column was included to anchor each patient in a previous experience that, to this point, would qualify as the worst pain ever endured. The patient is asked if they need pain medication at that point in time. The patient’s edition only includes the table with the images on the left. The colored arrows seen in Figure 1 are present only for clarity for the reader in the study.

The original ABCs were modified for thyroid/parathyroid surgery to reflect the surgical site and includes functions such as neck movement. Of note, the ABCs scale is strictly experimental at this point in its production and is not used as a tool for guiding prescribing patterns or treatment.

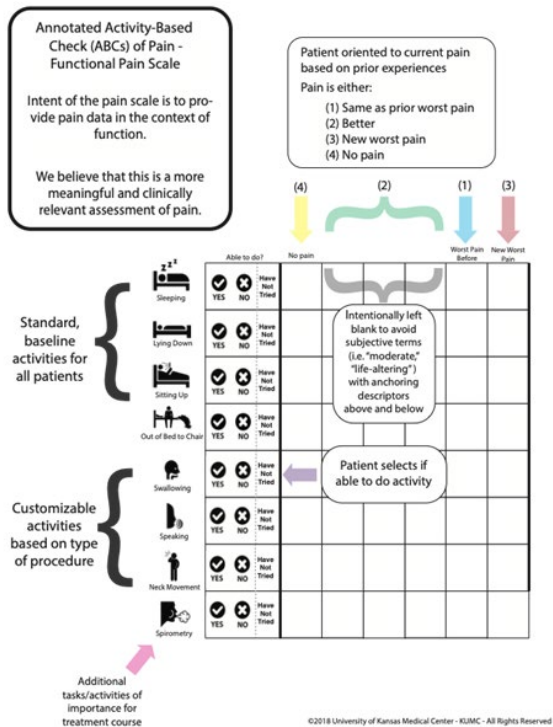


Figure 1. Annotated Activity-Based Check (ABCs) of Pain - Functional Pain Scale.

Enrollment Process. Eligible patients were identified through the pre-anesthesia clinic and enrolled at their pre-operative appointment. At this appointment, a team member would explain and review the ABCs and ensure that the subject was familiar with how to complete it properly. The SF-12 Health Questionnaire, the NRS Pain Scale, and the ABCs then were completed, which served as each patient’s “baseline” reference values. The SF-12 was used as a standard marker of overall health while the NRS and ABCs were used to establish a pre-operative baseline to compare scores. Two summary scores are reported from the SF-12, a mental component score (MCS-12) and a physical component score (PCS-12). The United States population average PCS-12 and MCS-12 are both 50 points, with a standard deviation of 10. The SF-12 is intended to measure the impact that a patient’s health plays on their everyday life.⁶ Our team obtained one SF-12 score pre-operative for each participant. This helped to compare our cohorts baseline quality of life as a reflection of health in comparison to the population.

Hospital Stay. Enrolled patients were entered into the Research Electronic Data Capture (REDCap[®]) database and followed throughout their post-operative course. The ABCs and 0 - 10 pain levels were collected once daily until discharge. The once daily scales collected during hospitalization for each patient were condensed into single indexes for each activity except for the last scale collected prior to discharge, which served as the value “at discharge”. The treating surgical

team was blinded to ABCs data to avoid biasing treatment.

Post-Operative Appointment. Patients were scheduled for a post-operative follow-up visit per the treating surgeon’s preference. This universally occurred within one to three weeks after discharge. The ABCs and 0 - 10 pain scale were administered and recorded as the “post-operative” value. The following information about pain medications was recorded: medication prescribed, number of pills prescribed, and number of pills taken.

Statistical Analyses. Data were analyzed using SPSS Version 26 (Armonk, NY). Descriptive statistics for scale variables were reported as medians (interquartile range). Spearman’s Rho was used to assess correlation between scale variables. Group comparisons were performed using Mann-Whitney U tests. Significance was set at $p < 0.05$.

RESULTS

Forty patients were enrolled to completion in this study. During the period of data collection, there was an estimated 110 patients that met our inclusion criteria. This provided a 12% margin of error at a 95% confidence interval, thus demonstrating that the sample generally represents the population. The mean age was 52 years; 82.5% were white, non-Hispanic, and 47.5% were male (Table 1).

The ABCs demonstrated correlation to the NRS at baseline ($\rho = 0.687, p < 0.01$), prior to discharge ($\rho = 0.881, p < 0.01$), and at post-operative follow-up visit ($\rho = 0.312, p < 0.05$; Table 2). The function that correlated most to the NRS at discharge was “Out of Bed to Chair” ($\rho = 0.691, p < 0.01$; Table 3). The function that correlated most with MME prescribed was “Out of Bed to Chair” at discharge ($\rho = 0.471, p < 0.01$; Table 4). Post-operative opioid prescription usage was correlated significantly to the amount of MME prescribed ($\rho = 0.559, p < 0.01$). Post-operative MME taken correlated to their pain score on the NRS scale ($\rho = 0.344, p < 0.05$) and the ABCs ($\rho = 0.303, p > 0.05$; Table 5). The function that demonstrated significant correlation with the amount of MME taken was “Out of Bed to Chair” at discharge ($\rho = 0.485, p < 0.01$). Indicators of better mental health on SF-12 were correlated inversely with MME consumption ($\rho = -0.35, p < 0.05$; Table 6).

Table 1. General patient demographics.

Demographics	N = 40 (%)	Mean [SD]
Age		51.7 [16.4]
Short Form Survey (SF-12)		
Mental Component Score (MCS-12)		51.6 [8.5]
Physical Component Score (PCS-12)		45.5 [10.1]
Gender		
Male	19 (47.5)	
Female	21 (52.5)	
Ethnicity		
White	36 (90)	
Hispanic	2 (5)	
Asian American	1 (2.5)	
African American	1 (2.5)	
Procedure		
General Surgery	26 (65)	
Head & Neck	14 (35)	

Table 2. Correlation of numeric rating scale (NRS) to Activity-Based Checks (ABCs) at varying time points.

Correlation of NRS to ABCs at:	ρ (Rho)	p value
Baseline	0.687	p < 0.01
Discharge	0.881	p < 0.01
Post-operative	0.312	p < 0.05

Table 3. Correlation of numeric rating scale (NRS) to Activity-Based Checks (ABCs) functions at baseline.

Action	ρ (Rho)	p value	Cohort
Out of bed to chair	0.691	p < 0.01	
Lying down	0.64	p < 0.01	
Sleeping	0.556	p < 0.01	
Sitting up	0.521	p < 0.01	
Walking up stairs	0.534	p < 0.01	General Surgery only
Swallowing pain	0.622	p < 0.05	Head & Neck Surgery only

Table 4. Correlation of milligrams of morphine equivalents (MME) prescribed.

	ρ (Rho)	p value	Performed
Numeric Rating Scale (NRS)	0.412	p < 0.01	at discharge
Activity-Based Checks (ABCs)	0.401	p < 0.05	at discharge
Out of bed to chair	0.471	p < 0.01	at discharge
Lying down	0.369	p < 0.05	at discharge
Sleeping	0.375	p < 0.05	at discharge
Sitting up	0.310	p > 0.05	at discharge
Walking up stairs	0.359	p > 0.05	at discharge
Swallowing pain	-0.052	p > 0.05	at discharge

Table 5. Correlation of milligrams of morphine equivalents (MME) taken.

	ρ (Rho)	p value	Performed
MME prescribed	0.559	p < 0.01	
Numeric Rating Scale (NRS)	0.344	p < 0.05	at discharge
Activity-Based Checks (ABCs)	0.303	p > 0.05	at discharge
Out of bed to chair	0.485	p < 0.01	at discharge
Mental Component Score (MCS-12)	-0.35	p < 0.05	

Table 6. MME prescribed and taken by procedure type.

MME prescribed and taken	Mean [SD]
General Surgery	
MME prescribed	153.4 [83.6]
MME taken	87.9 [99.2]
Head & Neck	
MME prescribed	126.8 [61.6]
MME taken	21.4 [36.0]

DISCUSSION

This study investigated the efficacy of the Activity-Based Checks of Pain (ABCs) to assess peri-operative pain in comparison to the current standard of care using a 0 - 10 numeric rating scale (NRS). The impetus for this study was the lack of a “gold standard” for measuring the functional impacts of pain in a post-operative setting and

the limited clinical utility of the current 0 - 10 NRS.⁷ Based on the findings of this study, the ABCs pain scale was comparable to the current standard practice of peri-operative pain assessment using the NRS. The functions on the ABCs scale that demonstrated significant correlation with the amount of MME taken were “Out of Bed to Chair”. Interestingly, the factor that was correlated most strongly with opioid MME taken was not pain, but quantity prescribed.

The 0 - 10 NRS gained popularity in the 2000s and has been collected as a vital sign for the past decade, although it was not validated as a screening tool. Unlike vital signs such as heart rate and blood pressure, there is little guidance regarding optimal treatment of pain levels that are outside of what is expected or desired. Correlation of opioids prescribed with pain at discharge varied based on clinical setting. For example, opioid MME prescriptions are correlated inversely with documented NRS pain scores in the emergency department setting.⁵

Using functional markers to assess acute pain helps the provider and patient personalize care towards the patients’ goals. This will improve post-operative opioid decision making for pain management, while minimizing the harms that can be associated with opioid analgesics. Pilot testing of this novel, visual, and functional pain scale showed the potential utility a scale such as this could serve in the future.

Determinants of post-operative opioid usage are multifactorial. Our study is consistent with prior literature demonstrating that prescribing patterns drive consumption patterns.^{5,8,9} For example, a large retrospective population-based study also found that the quantity of opioid prescribed is associated with higher patient-reported opioid consumption, with 77% of patients taking one-half or less of the prescribed pills.⁸ Similarly, the strongest correlation with MMEs taken after discharge was MMEs prescribed. These data also agreed with our findings that over 40% of prescribed opioids goes unused (Table 6). This indicated that, even if patients can avoid overuse of prescribed opioids, an excess remains in circulation at risk for misuse or diversion. This is significant as 75% of those addicted to opioids report prescription drugs as their first opioid exposure.¹⁰

These data underscored that neither pain scale proved to be the main determinants of opioid analgesic usage, and the need for improved methods of pain assessment that can be incorporated meaningfully into clinical decision making. Ideally, such methodology would address systems barriers to pain assessment and management such as failure to adopt a standardized pain assessment tool beyond the NRS 0 - 10 or other numeric scale and lack of clinician time to document multi-dimensional aspects of pain. Attempts to address these issues have yielded pain scales that attempt to capture pain’s impact on function and quality of life.^{11,12} However, their rating system can be complex. For example, the Indiana Polyclinic Combined Pain Scale requires a specifically trained clinician to conduct the test.¹¹ Typically, patients must respond to written prompts on a Likert-scale,

which can be mentally taxing for the participant, especially if recovering from anesthesia or analgesics. These limitations restrict their use in an acute post-operative setting.

In contrast, the ABCs scale was designed to be highly visual in nature. Visual relay of information has been shown to decrease the cognitive effort required to both complete and interpret information.¹¹ The functions included in the ABCs also can be customized for different procedures and patient populations. Ultimately, the best way to assure that pain is addressed properly is by utilizing an interprofessional team that approaches pain assessment using a multidimensional approach, making the development of a function-based pain scale essential for a progressive step against the opioid epidemic.

LIMITATIONS

This was a pilot study with a relatively small sample size. The study population consisted mainly of patients in a tertiary academic center undergoing parathyroid/thyroidectomy procedures or lymph node dissections, and recovery was typically quick, uncomplicated, and without significant pain burden. However, patients routinely experienced measurable, post-operative pain that the team was able to track over time using the ABCs pain scale.

Despite recognizing that functional pain assessment is important, there are no clear guidelines regarding which functions to assess. Further discussion with physicians and patients will aid in finding specific functional milestones that patients desire to reach.

Although the goal of this study was not to ascertain patient perspectives on the ABCs, confusion for patients while recording their pain levels was noted. Since patients have become accustomed to quantifying their pain through the NRS scale over the last couple decades, it was difficult with some patients to grasp the concept of functional pain instead of numerical pain. It was not believed that this significantly biased the results because of the descriptive anchors provided at the two extremes of the scale.

Future Directions. Given that functional priorities may be individualized, future mixed-methods studies will investigate patient attitudes towards pain assessment, including the ABCs. We also will investigate the utility of the ABCs as a tool to facilitate communication about pain between patients and their care teams. As MMEs prescribed, and not pain levels, were highly correlated to MMEs taken after discharge, future studies will investigate educational interventions (or integrating pain scales into discharge analgesic prescribing decisions) on prescribing patterns.

Lastly, not only did amount of MMEs prescribed have a stronger correlation than the NRS and the ABCs scale with amount of MMEs taken, “Out of Bed to Chair” also had a stronger correlation. This further highlighted the novelty of this research into function-based pain scales. The ABCs scale, although visually appealing and more simple than previously proposed scales, might have potential to be simplified further as more research is done into which activities correlate best with different procedures further streamlining efforts to provide individualized care

for patient’s pain-control. Continued study into functional methods of pain quantification could prove to be beneficial considering the strong correlation “Out of Bed to Chair” measurement proved to be in relation to amount of MMEs taken.

CONCLUSIONS

The primary purpose of the study was to assess the correlation between a novel, visual, and functional pain scale compared to the current 0 - 10 numeric rating scale. The strongest predictor of MMEs taken by patients was MMEs prescribed. Knowing this should provide health professionals with great pause as we look to provide evidence-based, quality pain-control to each patient. Having more tools available, such as the ABCs pain scale, when making decisions for patients’ post-operative pain management can provide more individualized care and aid physicians to practice proper opioid stewardship.

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