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Preoperative Pressure Pain Threshold Is Associated With Postoperative Pain in Short-Stay Anorectal Surgery: A Prospective Observational Study

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BACKGROUND: Postoperative pain management is key for patient satisfaction. Pressure pain threshold (PPT) has been studied in some surgical cohorts but has not been studied in relationship to acute postoperative pain in short-stay patients undergoing anorectal surgery. We hypothesized that preoperative finger PPT measurements can identify respective patients with higher postoperative pain. Aiming to understand the relationship with subjective postoperative pain perception, we tested the hypotheses that preoperative PPT is associated with postoperative Visual Analog Scale (VAS) pain scores and correlates with postoperative analgesic consumption in short-stay patients undergoing anorectal surgery.

METHODS: We prospectively assessed preoperative PPT in a cohort undergoing anorectal surgery, known as a moderately to severely painful procedure. Linear mixed-effects models were used to assess the relationship with postoperative VAS pain scores at 1 and 3 days as well as 4 weeks postoperatively. Logistic regression was used to study the relationship with additional postoperative analgesic consumption.

RESULTS: We studied 128 patients and found that preoperative PPT is significantly associated with postoperative pain (*P* value for interaction = .025). Logistic regression modeling additionally revealed an association between the preoperative PPT and the need for additional postoperative analgesics, with odds of requiring additional analgesia decreasing by about 10% for each 1-point increase in PPT (odds ratio [OR] = 0.90; 95% confidence interval [CI], 00.81–0.98; *P* = .012).

CONCLUSIONS: Preoperative finger PPT is associated with postoperative pain and might help identify patients who are at risk of developing more severe postoperative pain on anorectal surgery. Especially in ambulatory and short-stay settings, this approach can help to address patients' high variability in pain sensitivity to facilitate appropriate postoperative analgesia, timely discharge, and prevent readmission. (Anesth Analg XXX;XXX:00–00)

KEY POINTS

- **Question:** Is preoperative pressure pain threshold associated with postoperative pain in anorectal surgery?
- **Findings:** Preoperative pressure pain threshold is associated with postoperative pain in anorectal surgery and can help identify patients at risk for developing more severe postoperative pain.
- **Meaning:** Preoperative pressure pain can anticipate postoperative pain in anorectal surgery, thereby facilitating planning for surgery and avoiding readmission due to pain.

GLOSSARY

CI = confidence interval; **ERAS** = Enhanced Recovery After Surgery; **GLMM** = generalized linear mixed=effects models; **i.v.** = intravenous; **IRB** = institutional review board; **OR** = odds ratio; **p.o.** = per os; **PACU** = postanesthesia care unit; **postop.** = postoperative; **PPT** = pressure pain threshold; **ROC** = receiver operating characteristic; **s.c.** = subcutaneous; **SD** = standard deviation; **STROBE** = STrengthening the Reporting of OBservational studies in Epidemiology; **VAS** = Visual Analog Scale

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The pressure to treat surgical patients in an ambulatory or short-stay setting is increasing globally, but appropriate postoperative pain management remains a major challenge.[1,2] Current guidelines for colorectal and anorectal surgery recommend discharging patients only after achievement of a subjectively low level of pain,[3] but pain is among the primary reasons for readmission after anorectal surgery.[4] Recently published Enhanced Recovery After Surgery (ERAS) protocols for short-stay anorectal and colorectal surgery recommend the implementation of differentiated pain management to reduce both postoperative pain and readmissions,[5,6] but patients' sensitivity to pain is highly variable[7,8] and influenced by complex factors such as sex[8] and anxiety.[9]

While the pressure pain threshold (PPT) method has been studied in various settings, it became a standard for quantitative sensory tests. In brief, a calibrated pressure gauge featuring electronic recording of maximal pressures applied is used to determine thresholds where pressure is subjectively perceived as pain.[10] Preoperative pressure pain sensitivity was associated with pain severity before and after joint replacement[11,12] and abdominal surgery,[13] and a recent systematic review revealed that central pain processing is consistently associated with PPT.[14]

This method might be valuable for anticipating postoperative pain and subsequently the need for postoperative analgesics in ambulatory or short-stay settings such as anorectal surgery, enabling proactive planning and organization of adequate postoperative care and pain therapy. However, anorectal patients have not been studied before and it is unknown whether these patients' postoperative pain perception can be anticipated to plan for short-stay surgery. Further, whether the preoperative PPT correlates with a need for postoperative analgesics in patients undergoing anorectal surgery remains unexplored.

Therefore, we aimed to understand the association between preoperative PPT and subjective postoperative pain perception in patients undergoing anorectal surgeries of comparable complexity. We further aimed to determine whether the preoperative PPT inversely correlates with a need for postoperative analgesics and could, therefore, potentially be used to identify patients with higher analgesia demands. For our primary aim, we tested the hypothesis that the preoperative PPT is associated with postoperative Visual Analog Scale (VAS) scores. Secondarily, we tested the hypothesis that the preoperative PPT is associated with postoperative analgesic consumption.

METHODS

Based on §15 of its professional code of conduct, the study was approved by the Niedersachsen Medical Association's ethics committee (Hannover, Germany, chair Prof Dr Andreas Creutzig, MD) as the responsible appropriate institutional review board (IRB). Written informed consent was obtained from all subjects undergoing anorectal procedures of comparable complexity at the St Marien-Hospital.

This prospective single-center observational study was conducted at the St Marien-Hospital in Vechta, Germany, a 321-bed teaching hospital with specialized anorectal and colorectal surgery. Participants' PPT was assessed preoperatively as described in more detail below, and VAS pain scores (primary outcome, recorded on a discrete integer scale, with marked categories ranging from 0 to 10 points) were recorded preoperatively and on postoperative days 1 and 3, as well as after 4 weeks. Table 1 displays the perioperative analgesia strategy. Preoperative local lidocaine 2% ointment was self-applied upon prescription by the family doctor in patients with preoperative pain.

Table 1. Study Setup Including Institutional Regimen for Pain Therapy in Patients Undergoing Anorectal Surgery and Patient Demographics, Baseline Characteristics, and Surgical Characteristics (n = 128)[a]

Institutional Regimen for Pain Therapy in Patients Undergoing Anorectal Surgery	
Day of surgery (on PACU discharge)	Metamizole[b] (maximum 4 × 1 g/24 h i.v.) ± optional Piritramide (single dose of 7.5 mg s.c.)
From postoperative day 1	Metamizole[b] and diclofenac[b] (3 × 46.5 mg p.o.)
Patient Demographics, Baseline Characteristics, and Surgical Characteristics (n = 128)[a]	
Age, y	46.7 (16.0)
Weight, kg	80.1 (17.4)
Height, cm	171.9 (9.7)
Marital status	
Unmarried	45 (35.2%)
Married	72 (56.3%)
Divorced/widowed	11 (8.6%)
No. of children	1 [0, 2 (0–5)]
Previous surgery	
Total previous operations	1 [0, 2 (0–8)]
Previous anorectal or colorectal operations	0 [0, 0 (0–2)]
Main diagnosis	
Anal fissure	14 (10.9%)
Anal fistula	10 (7.8%)
Anal vein thrombosis	19 (14.8%)
Condyloma	10 (7.8%)
Hemorrhoids	43 (33.6%)
Pilonidal sinus disease	16 (12.5%)
Rectal prolapse	11 (8.6%)
Other	5 (3.9%)
Preoperative VAS pain score	1 [1, 2 (1–8)]
Preoperative anxiety score	1.5 [1.5, 2.5 (1–6)]
Duration of surgery, min	15.5 [13.0, 22.5 (6–82)]
Duration of intraoperative current application	3 [2, 4 (0–10)]
Hospital length of stay, d	1 [1, 2 (1–4)]

Abbreviations: i.v., intravenous; p.o., per os; PACU, postanesthesia care unit; s.c., subcutaneous; SD, standard deviation; VAS, Visual Analog Scale.

[a]Data are mean (SD), median [quartiles (range)], or numbers and percentages.

[b]If contraindication for either Metamizole or Diclofenac, patients received Paracetamol (maximum 4 g/24 h).

None of the patients received any opioids or neuroleptic medication preoperatively. Postoperative analgesia consumption (secondary outcome) and baseline demographic (sex, age, pain history, previous pain medication, disease history, previous operative and nonoperative treatments) and intraoperative characteristics (time of surgery, duration, surgeon, findings, intraoperative procedures, duration of bipolar cautery) were also recorded. The article was prepared using the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) Statement.[15]

Patient Recruitment

After consent for the surgical intervention was obtained, patients were asked if they were willing to participate in the study. Inclusion criteria were fully cooperative patients proficient in the German language, suitable for anorectal surgery, without psychiatric disease and without history of chronic pain or an acute pain problem besides the surgical diagnosis. Exclusion criteria were a history of and/or treatment for psychiatric disorders or chronic pain.

All patients received general anesthesia for the anorectal procedure. With the exception of individuals undergoing pilonidal sinus surgery (12.5%), all patients received a pudendal block intraoperatively.

Algometers are used to reliably quantify pressure forces and therewith individual PPT.[16] We used the established and validated J-Tech Commander Algometer Baseline 1200-304 (Push-Pull Force Gauge; JTECH Medical Industries, Inc, Midvale, UT) to assess PPT with a 0.5 cm^2 round rubber tip applied to the subjects' skin (Supplemental Digital Content, Figure 1, http://links.lww.com/AA/D144) in an undisturbed setting, according to current guidelines.[17] The maximum value reached during the test was electronically stored by the algometer algorithm and could be visualized and downloaded at the end of the test. We tested the ring finger of the right hand and the little finger of the left hand with 5 measurements on each side. All testing were done by 1 surgeon (B.H.) after training according to the manufacturer's instructions during surgery clinic visit. After explanation and demonstration, pressure was increased in a gentle continuous way till pressure was felt as VAS 3. Pressure measurements were recorded and a mean ± standard deviation (SD) calculated separately for each hand. Because left and right hands consistently provided identical values when tested, we calculated mean values for both hands but did not record which hand was dominant. The average of all 10 measurements from both hands was calculated and defined as the PPT, measured in lbs. VAS documentation and finger pressure measurements were taken preoperatively, at day 1, day 3, and 4 weeks following surgery, in connection with the patient's visit for surgical follow-up in the outpatient clinic.

Statistical Analysis

Data are summarized as counts and percentages (categorical variables), means and SDs (approximately normally distributed continuous variables), or medians and quartiles (not normally distributed variables). Data distribution was assessed with histograms, Q–Q plots, and Shapiro–Wilk tests. Explorative analyses were performed to assess the change in VAS scores over time using the Friedman test and subsequent pairwise comparisons with Wilcoxon signed-rank tests. Multiple pairwise comparisons were adjusted with the Bonferroni technique, and adjusted *P* values are reported.[18]

Relationship Between Preoperative PPTs and Postoperative VAS Scores

The unadjusted relationship between the preoperative PPT and VAS scores at different time points (primary outcome) was initially explored using Spearman rank correlation.[19] For subsequent analyses, to account for within-subject correlation between multiple VAS measurements per subject, generalized linear mixed-effects models (GLMMs) were used.[20] The discrete postoperative VAS score was the dependent variable in all models, modeled as a continuous outcome using an identity link function. In an initial step, different model specifications were compared (random intercept, random intercept and slope, and marginal models with various residual covariance structures). The marginal model with unstructured residual covariance was selected for subsequent model building, as it had the lowest Akaike information criterion.

Multivariable model building was performed as follows: first, an unadjusted model was fit to determine the crude relationship between the preoperative PPT and VAS scores over time, including only preoperative PPT, time (as categorical factor), and their interaction as independent variables. Next, an adjusted model was built, liberally forcing potential confounders into the model as independent variables.[21] This model controlled for the following variables: baseline VAS score, duration of preoperative pain, main anorectal diagnosis, patient sex, age, weight and height, marital status, number of children, number of previous operations, and number of previous anorectal or colorectal operations. Regression parameters in both models were obtained using Restricted Maximum Likelihood estimation. For both models, residuals were assessed for a normal distribution, and the models satisfied this assumption. While the distributional assumptions were satisfied, and while VAS scores are commonly modeled as a continuous outcome in pain research, the VAS was measured on an ordinal scale

in this study. We therefore also modeled VAS scores as an ordinal outcome as a sensitivity analysis, using a logit link function in the GLMM.

Relationship Between Preoperative PPT and Postoperative Analgesic Consumption

The secondary outcome was the relationship between the preoperative PPT and postoperative analgesic consumption. Patients received pain medication in hospital per fixed schedule plus add-on medication on demand. The on-demand medication in excess to the fixed schedule (as outlined on Table 1) was defined as extra postoperative analgesic requirement. In hospital, patients received a combination of analgesics, using >1 route of administration (intravenous, subcutaneous). The only opioid given postoperatively was piritramide (analgesic potency 0.7 of that of morphine). Besides the standard analgesic therapy, few patients received add-on medication in hospital. Because determining equianalgesic doses of the administered opioid analgesics is challenging,[22] we did not calculate and analyze cumulative standardized analgesia doses per patient. Rather, we determined which patients required additional postoperative analgesia, defined as additional doses of piritramide and/or paracetamol on top of (rather than instead of) diclofenac and metamizole, and analyzed the relationship between the preoperative PPT and the requirement for additional postoperative analgesia. Table 1 provides an overview of the institutional pain regimen and defines additional analgesia requirements in detail.

Logistic regression was used to analyze the relationship between the preoperative PPT and additional analgesia requirements.[23] The discriminative ability was assessed using a receiver operating characteristic (ROC) curve.[24] As there were only 11 patients with additional analgesia requirements, adjustment for covariates was not possible and exact logistic regression was performed to avoid small-sample bias.

Two-sided P values <.05 were considered statistically significant. All statistical analyses were performed in Stata/IC 16.0 (StataCorp, College Station, TX).

Sample size determination for GLMM with a large number of covariates is not straightforward and heavily depends on uncertain assumptions. We therefore did not perform an a priori sample size calculation and used the more straightforward approach to justify the sample size after the study was completed, based on the crude correlation between the preoperative pressure sensitivity and postoperative VAS score. The available sample size provides >90% power to detect a correlation of at least 0.3 between preoperative pressure sensitivity and the postoperative pain score at a .05 α level.

RESULTS

Demographics and Baseline Characteristics

Initially, 129 patients consented to participate in this prospective trial. With 1 patient lost to follow-up, 128 patients (65 men, 63 women) were included in the analyses. Table 1 provides an overview of the primary diagnosis and baseline patient characteristics. More than 90% of patients were treated ambulatory or short stay (1 postoperative night) to discharge (median length of stay: 1 day, mean length of stay 1.5: day; 95% confidence interval [CI], 1.44–1.72).

Relationship Between Preoperative PPT and Postoperative VAS Scores

The median preoperative VAS score was 1 [1, 2] in patients suffering from anorectal surgical diagnoses, as highlighted in Table 1. Postoperative VAS scores were 4 [2, 4] on the day after surgery, then decreased to 2 [2, 3] and 1 [1, 2] 3 days and 4 weeks postoperative, respectively. Figure 1 displays the dynamics of perioperative VAS scores. Spearman rank correlation between the preoperative pressure threshold and VAS scores was −0.16 on postoperative day 1 (P = .065), −0.33 on day 3 (P < .001), and −0.38 in week 4 (P < .001). Likewise, the linear mixed-effects models demonstrated a significant relationship between preoperative pressure thresholds and postoperative pain (P value for interaction: unadjusted model = .025, adjusted model = .025 Table 2). Due to the significant interaction, the relationship between preoperative pressure thresholds and postoperative pain scores differed depending on the time point (Figure 2; Table 2). The estimated change in VAS scores for a 1-point increase in the threshold on postoperative day 3 was −0.035 (95% CI, −0.052 to −0.019; P < .001) and 0.022 (95% CI, −0.039 to −0.004; P = .014) in the unadjusted and adjusted models, respectively. The sensitivity

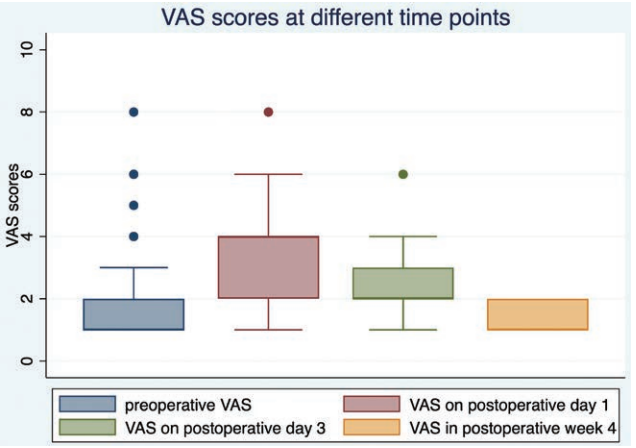

Figure 1. VAS scores reported perioperatively. Friedman test P < .001, pairwise post hoc tests with Wilcoxon signed-rank tests. and Bonferroni adjustment: ** indicates P < .001, * indicates P < .05. VAS indicates Visual Analog Scale.

Table 2. Relationship Between the Preoperative Pressure Threshold, Estimated From the Unadjusted and the Adjusted Linear Mixed-Effects Models[a]

	Coefficient (95% CI)	*P* Value
Unadjusted Model		
Effect of preoperative pressure threshold		
On VAS on day 1	−0.021 (−0.044 to 0.002)	.068
On VAS on day 3	−0.035 (−0.052 to −0.019)	<.001
On VAS in week 4	−0.019 (−0.028 to −0.010)	<.001
Main effect of time		<.001
Interaction		.025
Adjusted Model		
Effect of preoperative pressure threshold		
On VAS on day 1	−0.008 (−0.030 to 0.014)	.494
On VAS on day 3	−0.022 (−0.039 to −0.004)	.014
On VAS in week 4	−0.006 (−0.017 to 0.006)	.322
Main effect of time		<.001
Interaction		.025

Abbreviations: CI, confidence interval; VAS, Visual Analog Scale.

[a]The coefficients for the preoperative pressure threshold reflect the expected change in the VAS score at the respective time point for a 1-point increase in the threshold. Interaction refers to the interaction between the preoperative pressure threshold and time.

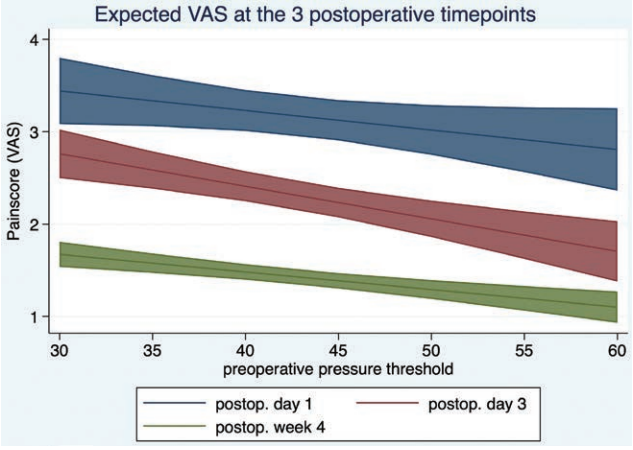

Figure 2. Relationship between preoperative pressure threshold (lbs) and VAS scores reported after surgery. Postop. indicates postoperative; VAS indicates Visual Analog Scale.

analysis considering VAS as an ordinal rather than a linear score gave consistent results (*P* values for interaction = .002 and <.001, respectively).

Relationship Between Preoperative PPT and Postoperative Analgesic Consumption

Assessing the relationship between the preoperative PPT and additional postoperative analgesic consumption reveals an odds ratio of 0.90 (95% CI, 00.81–0.98; P = .012), suggesting that the odds of requiring additional analgesia decrease by about 10% for each 1-point increase in PPT. Figure 3 shows the probability of additional postoperative analgesics in relation to the preoperative finger PPT. ROC analysis suggests that dolorimetry might potentially be useful in anticipating patients with additional postoperative analgesia requirements (area under the curve = 0.76; 95% CI, 0.58–0.94).

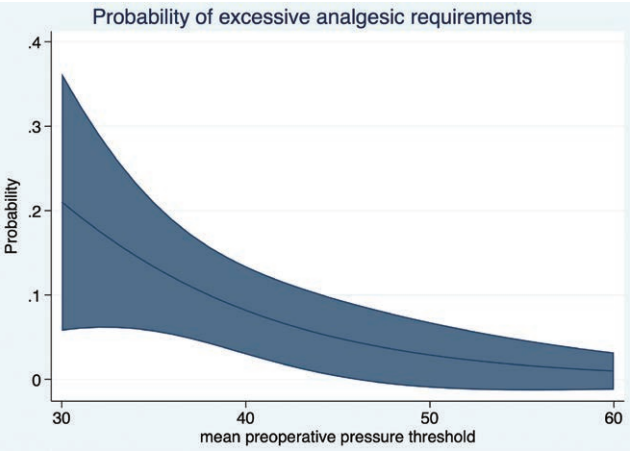

Figure 3. Inverse relationship between the preoperative pressure pain threshold (lbs) and the probability of requiring additional postoperative analgesia: the odds of requiring additional analgesia decrease by about 10% for each 1-point increase in pressure pain threshold. The analgesic potency of piritramide is 0.7 of that of morphine.

DISCUSSION

Our study is the first assessing the relationship between preoperative PPT and postoperative pain management in patients undergoing short-stay anorectal procedures potentially manageable in an ambulatory or short-stay setting. The prospective single-center observational study in 128 patients undergoing anorectal surgery reveals that preoperative PPT is significantly associated with postoperative pain. Logistic regression modeling additionally shows an association between the preoperative PPT and the need for additional postoperative analgesics, with odds of requiring additional analgesia decreasing by about 10% for each 1-point increase in PPT.

Not surprisingly, our explorative analyses show that VAS scores change over time after the operation. Moreover, we identified a relationship between PPT and postoperative pain. This finding confirms that PPT can be used in surgical cohorts undergoing short-stay anorectal surgery. While preoperative PPT certainly cannot directly predict postoperative pain scores, the major strength of our study is that it demonstrates an association between the 2. It seems that it may be useful in determining which patients may need more analgesics postoperatively. The fact that not all patients received the same analgesics may explain in part why we do not find a strong correlation with VAS scores. Patients who complained about additional postoperative pain received increased pain management including, for example, pudendal blocks or additional doses of piritramide and thus did not reach much higher VAS scores in the end.

While PPT is an established method to track pain in various settings, it has never been proved as a concept for acute postoperative pain in anorectal surgery, a field known for both the possibility for ambulatory

or short-stay management but also significant postoperative pain burden. With 1 exception about hernia repair[25] and lithotomy,[26] previous studies about using preoperative PPT measurements to predict postoperative pain after elective surgery mainly focused on elective orthopedic,[27–29] chest,[30–32] and gynecological[13,33–35] surgeries and obstetrics[36–40] with postoperative in-hospital stays of mostly several days revealed heterogeneous findings. Several articles studying pressure pain measurements in patients undergoing day-care surgery are available. While preoperative thermal or pressure pain correlates with postoperative pain in cohorts undergoing day-care knee arthroscopy for anterior cruciate ligament repair,[27] percutaneous nephrolithotomy,[26] or minor gynecological surgeries,[33,34] such associations were disproved in patients undergoing groin hernia repair.[25] For more extensive surgeries with multiple postoperative days spent in hospital,[13,28–32,35–39] an association between preoperative pain thresholds was shown for gynecological procedures and cesarean deliveries as well as for knee replacements. Evidence for thoracic procedures is inconsistent. Supplemental Digital Content, Table 1, http://links.lww.com/AA/D144, provides an overview of available evidence.

Our findings help identify patients undergoing short-stay anorectal surgery potentially at risk for experiencing greater postoperative pain or requiring more analgesia early in their treatment course. Especially in the ERAS setting, such a screening tool may be valuable, ensuring appropriate pain control and reduced readmission rates. An extended study design using large test and validation cohorts to design a robust prediction model for postoperative pain might be of great value. Our findings suggest that measurements of preoperative PPT may be a useful component in a multimodal assessment of the anticipated pain response, warranting further investigations.

Our prospective work is limited by the single-center design, which restricts the data to a single nation cohort. Other cultural backgrounds may give differing results. However, the multivariable analysis adjusting for a manifold of different parameters provides valid understanding in this setting. The analysis of the secondary outcome could not be adjusted for confounding due to the limited number of patients with additional analgesia requirements, and should be interpreted cautiously. The fact that some patients received a pudendal nerve block with reduced cumulative analgesia requirements might be a confounding factor. Yet, this variability likely reflects current practice. We did not record opioid consumption post discharge but, unlike in other health care systems, such analgesics were neither provided by us nor the family doctors.

In conclusion, use of a preoperative finger PPT is associated with postoperative pain in short-stay anorectal surgery and might aid in the identification of patients who are at risk for developing more severe postoperative pain. Furthermore, we identified a relationship between PPT and additional analgesic consumption in this prospectively assessed cohort. In the ambulatory and/or short-stay setting with ERAS policies in place, such testing can help to address the high variability in patients' pain sensitivity and facilitate planning for ambulatory or short-stay surgery. It can also avoid readmission due to pain and can potentially be used to help predict who might need to be admitted after ambulatory surgery because of pain. ■

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DISCLOSURES

Name: Markus M. Luedi, MD, MBA.
Contribution: This author helped with the conception and design of the study, analysis and interpretation of data, drafting the article, and approved the final version to be submitted.
Conflicts of Interest: M. M. Luedi is a member on the editorial board of *Anesthesia & Analgesia*.
Name: Patrick Schober, MD, PhD, MMedStat.
Contribution: This author helped with the conception and design of the study, analysis and interpretation of data, drafting the article, and approved the final version to be submitted.
Conflicts of Interest: P. Schober is a member on the editorial board of *Anesthesia & Analgesia*.
Name: Bassam Hammoud, MD.
Contribution: This author helped with the conception and design of the study, acquisition of data, analysis and interpretation of data, drafting the article, and approved the final version to be submitted.
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REFERENCES

1. Vinson-Bonnet B, Higuero T, Faucheron JL, Senejoux A, Pigot F, Siproudhis L. Ambulatory haemorrhoidal surgery: systematic literature review and qualitative analysis. *Int J Colorectal Dis*. 2015;30:437–445.
2. Abrishami A, Chan J, Chung F, Wong J. Preoperative pain sensitivity and its correlation with postoperative pain and

analgesic consumption: a qualitative systematic review. *Anesthesiology*. 2011;114:445–457.
3. Vinson Bonnet B, Juguet F; French National Coloproctology Society. Ambulatory proctologic surgery: recommendations of the French National Coloproctology Society (SNFCP). *J Visc Surg*. 2015;152:369–372.
4. Xia W, Barazanchi AWH, MacFater W, Sammour T, Hill AG. Day case versus inpatient stay for excisional haemorrhoidectomy. *ANZ J Surg*. 2019;89:E5–E9.
5. Parrish AB, O'Neill SM, Crain SR, et al. An enhanced recovery after surgery (ERAS) protocol for ambulatory anorectal surgery reduced postoperative pain and unplanned returns to care after discharge. *World J Surg*. 2018;42:1929–1938.
6. Gustafsson UO, Scott MJ, Hubner M, et al. Guidelines for perioperative care in elective colorectal surgery: enhanced recovery after surgery (ERAS®) society recommendations: 2018. *World J Surg*. 2019;43:659–695.
7. Kindler CH, Harms C, Amsler F, Ihde-Scholl T, Scheidegger D. The visual analog scale allows effective measurement of preoperative anxiety and detection of patients' anesthetic concerns. *Anesth Analg*. 2000;90:706–712.
8. Mogil JS. Sex differences in pain and pain inhibition: multiple explanations of a controversial phenomenon. *Nat Rev Neurosci*. 2012;13:859–866.
9. Moerman N, van Dam FS, Muller MJ, Oosting H. The Amsterdam preoperative anxiety and information scale (APAIS). *Anesth Analg*. 1996;82:445–451.
10. Petzke F, Khine A, Williams D, Groner K, Clauw DJ, Gracely RH. Dolorimetry performed at 3 paired tender points highly predicts overall tenderness. *J Rheumatol*. 2001;28:2568–2569.
11. Wylde V, Sayers A, Lenguerrand E, et al. Preoperative widespread pain sensitization and chronic pain after hip and knee replacement: a cohort analysis. *Pain*. 2015;156:47–54.
12. Luna IE, Kehlet H, Petersen MA, Aasvang EK. Clinical, nociceptive and psychological profiling to predict acute pain after total knee arthroplasty. *Acta Anaesthesiol Scand*. 2017;61:676–687.
13. Hsu YW, Somma J, Hung YC, Tsai PS, Yang CH, Chen CC. Predicting postoperative pain by preoperative pressure pain assessment. *Anesthesiology*. 2005;103:613–618.
14. van Helmond N, Aarts HM, Timmerman H, et al. Is preoperative quantitative sensory testing related to persistent postsurgical pain? A systematic literature review. *Anesth Analg*. 2020 [Epub ahead of print].
15. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *Lancet*. 2007;370:1453–1457.
16. Kinser AM, Sands WA, Stone MH. Reliability and validity of a pressure algometer. *J Strength Cond Res*. 2009;23:312–314.
17. Andersen S, Petersen MW, Svendsen AS, Gazerani P. Pressure pain thresholds assessed over temporalis, masseter, and frontalis muscles in healthy individuals, patients with tension-type headache, and those with migraine–a systematic review. *Pain*. 2015;156:1409–1423.
18. Schober P, Vetter TR. Adjustments for multiple testing in medical research. *Anesth Analg*. 2020;130:99.
19. Schober P, Boer C, Schwarte LA. Correlation coefficients: appropriate use and interpretation. *Anesth Analg*. 2018;126:1763–1768.
20. Schober P, Vetter TR. Repeated measures designs and analysis of longitudinal data: if at first you do not succeed-try, try again. *Anesth Analg*. 2018;127:569–575.
21. Schober P, Vetter TR. Confounding in observational research. *Anesth Analg*. 2020;130:635.
22. Luchting B, Rachinger-Adam B, Hulde N, Heyn J, Azad SC. Challenging equipotency calculation for hydromorphone after long-term intravenous application. *Ann Palliat Med*. 2017;6:S90–S94.
23. Vetter TR, Schober P. Regression: the apple does not fall far from the tree. *Anesth Analg*. 2018;127:277–283.
24. Vetter TR, Schober P, Mascha EJ. Diagnostic testing and decision-making: beauty is not just in the eye of the beholder. *Anesth Analg*. 2018;127:1085–1091.
25. Aasvang EK, Hansen JB, Kehlet H. Can preoperative electrical nociceptive stimulation predict acute pain after groin herniotomy? *J Pain*. 2008;9:940–944.
26. Pedersen KV, Olesen AE, Osther PJ, Arendt-Nielsen L, Drewes AM. Prediction of postoperative pain after percutaneous nephrolithotomy: can preoperative experimental pain assessment identify patients at risk? *Urolithiasis*. 2013;41:169–177.
27. Werner MU, Duun P, Kehlet H. Prediction of postoperative pain by preoperative nociceptive responses to heat stimulation. *Anesthesiology*. 2004;100:115–119.
28. Martinez V, Fletcher D, Bouhassira D, Sessler DI, Chauvin M. The evolution of primary hyperalgesia in orthopedic surgery: quantitative sensory testing and clinical evaluation before and after total knee arthroplasty. *Anesth Analg*. 2007;105:815–821.
29. Lundblad H, Kreicbergs A, Jansson KA. Prediction of persistent pain after total knee replacement for osteoarthritis. *J Bone Joint Surg Br*. 2008;90:166–171.
30. Lautenbacher S, Huber C, Kunz M, et al. Hypervigilance as predictor of postoperative acute pain: its predictive potency compared with experimental pain sensitivity, cortisol reactivity, and affective state. *Clin J Pain*. 2009;25:92–100.
31. Weissman-Fogel I, Granovsky Y, Crispel Y, et al. Enhanced presurgical pain temporal summation response predicts post-thoracotomy pain intensity during the acute postoperative phase. *J Pain*. 2009;10:628–636.
32. Yarnitsky D, Crispel Y, Eisenberg E, et al. Prediction of chronic post-operative pain: pre-operative DNIC testing identifies patients at risk. *Pain*. 2008;138:22–28.
33. Rudin A, Wölner-Hanssen P, Hellbom M, Werner MU. Prediction of post-operative pain after a laparoscopic tubal ligation procedure. *Acta Anaesthesiol Scand*. 2008;52:938–945.
34. Jarrell J, Ross S, Robert M, et al. Prediction of postoperative pain after gynecologic laparoscopy for nonacute pelvic pain. *Am J Obstet Gynecol*. 2014;211:360.e1–360.e8.
35. Brandsborg B, Dueholm M, Kehlet H, Jensen TS, Nikolajsen L. Mechanosensitivity before and after hysterectomy: a prospective study on the prediction of acute and chronic postoperative pain. *Br J Anaesth*. 2011;107:940–947.
36. Nielsen PR, Nørgaard L, Rasmussen LS, Kehlet H. Prediction of post-operative pain by an electrical pain stimulus. *Acta Anaesthesiol Scand*. 2007;51:582–586.
37. Strulov L, Zimmer EZ, Granot M, Tamir A, Jakobi P, Lowenstein L. Pain catastrophizing, response to experimental heat stimuli, and post-cesarean section pain. *J Pain*. 2007;8:273–279.
38. Pan PH, Coghill R, Houle TT, et al. Multifactorial preoperative predictors for postcesarean section pain and analgesic requirement. *Anesthesiology*. 2006;104:417–425.
39. Granot M, Lowenstein L, Yarnitsky D, Tamir A, Zimmer EZ. Postcesarean section pain prediction by preoperative experimental pain assessment. *Anesthesiology*. 2003;98:1422–1426.
40. Wilder-Smith CH, Hill L, Dyer RA, Torr G, Coetzee E. Postoperative sensitization and pain after cesarean delivery and the effects of single im doses of tramadol and diclofenac alone and in combination. *Anesth Analg*. 2003;97:526–533.