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Original Research

A Randomized-Controlled Trial Evaluating the Impact of a Web Tutorial on Perceptions and Usage of Opioids Post-Carpal Tunnel Release Surgery

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Purpose: The purpose of this study was to evaluate the efficacy of a web tutorial on perceptions of pain management and usage of opioids after carpal tunnel release surgery (post-CTR).
Methods: A web tutorial was developed by the authors, and patients were consented and enrolled if they were over the age of 18 years, could speak and understand English, and were having CTR. Patients were randomized to either view or not view the web tutorial before surgery, and all patients took a 19-question online survey approximately 2 weeks after surgery to assess their views on pain management and their self-reported opioid usage. All patients received standard-of-care instructions for post-operative pain management and were prescribed fifteen 5 mg tablets of oxycodone. Independent sample *t* tests, Wilcoxon rank sum tests, and chi-square tests were used to evaluate variables of interest.
Results: Sixty-seven patients were enrolled, with 17 lost to follow-up; therefore, 50 patients were included in the final study cohort and completed the online survey ($n = 25$/group). There were no statistically significant differences in age, gender (patient reported gender), race, and opioid use history between the groups, but there was a difference in education level with the group that did not watch the video having proportionally more participants whose highest level of education was postgraduate (36% vs 8%) and high school (24% vs 16%). There were no differences between groups in the perceptions of pain post-CTR based on survey statements, in reported opioid consumption on post-op day 1, or in perceived risk of prolonged opioid use. Conversely, on post-op days 2–6 (8% vs 28%) and 7–14 (0% vs 20%), fewer participants from the group that watched the video reported any opioid usage compared with the group that did not watch the video.
Conclusions: Our web tutorial did not notably impact the way patients perceived pain management or opioid risks post-CTR. However, a smaller proportion of the group that watched our tutorial reported opioid consumption post-CTR relative to the group that did not view our tutorial, suggesting that web tutorials may be a viable way to encourage patients to confer to minimal opioid usage and pain management regimens.
Type of study/level of evidence: Therapy/Prevention, Etiology/Harm IV.

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In 2021, 80,411 deaths in the United States occurred due to opioid-related overdose, and 16,416 of these were involving prescribed opioids.[1–5] Indeed, concerningly, reports suggest that some patients continue refilling and consuming opioids 3–6 months after their surgical procedure.[6,7] Emphasis has been placed on identifying the role of stakeholders (eg, surgeons) in the opioid epidemic and designing strategies to prevent opioid use, and this is especially true within the hand surgery community. For example, in 2018, Ilyas et al[8] demonstrated that acetaminophen and ibuprofen provided comparable pain relief to patient's post-carpal tunnel release surgery (CTR) when compared with oxycodone. In 2019, Weinheimer et al[9] had similar findings for other soft-tissue hand

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procedures. Similarly, written guidelines for surgeons were found to reduce the number of opioids prescribed.[10]

In addition to addressing the role surgeons play in prescribing opioids, a growing body of literature has increased attention toward patient education on opioids. Preoperative counseling and educational handouts for patients have both been found to significantly reduce the usage of opioids post-CTR.[10,11] However, several studies have demonstrated that language barriers, illiteracy, and/or education levels continue to be barriers to patient comprehension of opioid risks.[12] Importantly, a recent systematic review has demonstrated that these barriers continue to exist with counseling and educational handouts.[13] This same review did suggest, however, that patient education videos effectively prepare patients for diagnostic procedures by addressing the comprehension shortcomings of handouts and counseling.[13]

Therefore, building on this growing body of literature, we developed a web-based tutorial on pain management and opioid usage post-CTR. We then performed a randomized-controlled trial with the hypothesis that patients who watched the tutorial would have a better understanding of pain management and would discontinue opioid usage sooner in comparison to patients who did not watch the tutorial.

Materials and Methods

Web tutorial development

An 8-minute web tutorial was developed by the authors (J.R.F. and G.G.) to provide peer-reviewed, structured educational information on the current state of science regarding pain management and opioid use post-CTR. This tutorial was developed based on guidelines from previously reported studies that include providing simple and consistent messages and graphics, and clearly stating the goal of the video and the information being presented.[14] The web tutorial was not tested or screened prior to use in this study and was published on YouTube via a private link. The original video file is available in Appendix 1, available online on the Journal's website at https://www.jhsgo.org.

Study participants

Participants were included if they were over the age of 18 years, they were scheduled for CTR, and they could comprehend English. Eligible patients were approached by a research assistant at one of their pre-op visits. The University of Pittsburgh's institutional review board approved this study protocol prior to data collection, and informed written consent was obtained from all patients prior to enrollment in the study.

Study procedures

This study was performed in accordance with the Consolidated Standards of Reporting Trials (CONSORT) guidelines[15] (Appendix 2, available online on the Journal's website at https://www.jhsgo.org). After informed consent was obtained, the patients were randomized via coin flip to either watch the web tutorial or not watch the web tutorial. Specifically, the same investigator (J.G.) flipped the coin and allowed it to land on the countertop to settle.[16] Heads always indicated viewing the video, whereas tails always indicated not viewing the video. Patients who were assigned to the tutorial group watched the web tutorial via an iPad in the waiting area prior to their surgery and were also given the link to watch again at any time in their post-op recovery. No surgeries were delayed because of watching the video, and no time outside of the standard waiting for their procedure was requested of the patients to watch the video. All patients underwent endoscopic CTR by the same surgeon (J.R.F.); therefore, the incision size and location were standardized. All surgeries were of similar length and complexity, and there were no unexpected intraoperative findings that affected recovery. All patients in both groups received the institutional standard of care regarding pain management and opioid prescribing following CTR. Specifically, at our institution, standard of care is to encourage patients to manage pain with Tylenol and Motrin, but they are given a prescription of fifteen 5 mg tablets of oxycodone that they can fill if the patient deems it necessary. Patients were not given any refills. All patients (regardless of study group) are verbally told in the postanesthesia care unit that pain following CTR is normally manageable with Tylenol or Motrin and are told of the risks of using opioids, including sedation, dizziness, nausea, vomiting, constipation, physical dependence, tolerance, respiratory depression, and overdose. By chance, no patients enrolled in this study were on chronic opioid prescriptions before surgery as determined by the electronic medical record.

Seven days post-op, both groups of patients were emailed a 19-question online survey via Qualtrics. If the patient did not complete the survey within 1 week, two email follow-ups were sent within 30 days post-op. The survey aimed to capture demographic information about the participants, perceptions of pain management and opioid use post-CTR, and reported usage of opioids post-CTR. The specific survey used is available in Appendix 3, available online on the Journal's website at https://www.jhsgo.org. The survey was initially drafted by G.G. edited by J.R.F., and revised. No validation of survey questions was performed prior to administration. The study period was from May 9, 2022 to July 7, 2023. Participants completed survey questions without being in the presence of an investigator, but contact information was available should participants have questions. Of note, no participants reached out with any questions.

Statistical analysis

A prior power analysis determined a sample size of $n = 40$/group was needed to achieve a statistical power of 0.9. Descriptive statistics were used for patient demographics. Normality was checked of cardinal variables (age and days po-op that survey was taken) via Shapiro–Wilk tests. Of the two variables, age was normally distributed, and differences between study groups were evaluated via an independent samples t test. Differences between groups on non-normal cardinal variables (days post-op that survey was taken) and ordinal variables (questions ranking perceptions see Table 2) were evaluated via Wilcoxon rank sum tests. Differences between the groups on nominal variables (demographics in Table 1 and usage questions in Table 3) were evaluated via chi-square tests. An alpha level was set a priori to 0.05 for all statistical tests.

Results

Patient demographics

A convenience sample of 67 patients ($n = 32$ no video, $n = 35$ video) were enrolled in this study. However, 17 patients ($n = 7$ no video, $n = 10$ video) were lost to follow-up. With a resulting sample size of 25 participants per group, we achieved a statistical power of 0.7.[17] Sixty-seven patients met the inclusion criteria, were enrolled in this study, and consented to participate. Of these, 50 successfully completed the online survey. Patient demographics for both the group that watched the video and the group that did not are listed in Table 1. There were no differences between groups in age, gender, race, whether they had taken opioids before, and the day post-op they were taking the survey. Both groups included a large proportion of cisgender women (72% and 60%), White participants (96%

Table 1
Demographic Information of Patients Who Participated in Study Aimed to Assess the Effect of a Web Tutorial on Perceptions and Usage of Opioids Post-Carpal Tunnel Release Surgery*

Variable	Watched Video	Did Not Watch Video	Statistical Value	*P* Value
N	25	25		
Age (y)	53.8 ± 14.1	58.2 ± 14.7	1.069	.981
Gender			1.683	.641
Cisgender man	6 (24)	7 (28)		
Cisgender woman	18 (72)	15 (60)		
Nonbinary	0 (0)	1 (4)		
Transgender man	0 (0)	0 (0)		
Transgender woman	0 (0)	0 (0)		
Other/prefer not to say	1 (4)	2 (8)		
Race			2.2	.333
White	24 (96)	21 (84)		
Black	9 (4)	3 (12)		
American Indian or Alaska Native	0 (0)	0 (0)		
Asian	0 (0)	1 (4)		
Native Hawaiian or Pacific Islander	0 (0)	0 (0)		
Other	0 (0)	0 (0)		
Taken opioids before (% yes)	17 (68)	19 (76)	0.397	.529
Highest education			7.648	.022
Some high school	0 (0)	0 (0)		
Completed high school	4 (16)	6 (24)		
Completed college	19 (76)	10 (40)		
Postgraduate education (eg, PhD, JD)	2 (8)	9 (36)		
Days post-op at the time of survey	14.5 ± 7.6	15.8 ± 5.3	12	.285

* Age is reported as mean ± SD, and all other variables are reported as *n* (%). Age was assessed using an independent samples *t* test, and statistical value is the critical t. Days post-op at the time of survey was assessed via a Wilcoxon rank sum test, and the statistical value reported is the W. All other statistics were performed with a chi-square test, and the statistical value reported is χ^2.

Table 2
Perceptions on Pain Management and Opioid Usage Among Participants Who Watched the Web Tutorial and Those Who Did Not*

Statement	Watched Video ($n = 20$)	Did Not Watch Video ($n = 22$)	Statistical Value	*P* value
I expected to experience immediate relief of my symptoms after carpal tunnel release surgery.	3.6 ± 1.1	3.1 ± 1.3	2.489	.647
Almost all patients experience relief of symptoms after carpal tunnel syndrome.	2.4 ± 1.0	2.5 ± 1.1	5.706	.222
The best way to manage pain after carpal tunnel release syndrome is with opioids.	4.4 ± 1.3	4.1 ± 1.4	1.250	.741
Opioids are superior to nonopioids (eg, ibuprofen) at managing pain after carpal tunnel release syndrome.	4.1 ± 1.5	3.5 ± 1.5	4.547	.337
There are no risks associated with taking opioids for pain management after carpal tunnel release syndrome.	4.6 ± 1.0	4.2 ± 1.3	2.220	.528
I knew what to expect with my pain before carpal tunnel release surgery.	2.5 ± 1.6	2.1 ± 1.4	4.495	.343
I am satisfied with my pain management after carpal tunnel release surgery.	1.8 ± 1.5	2.0 ± 1.6	2.403	.662

* For all statements, the scale was set such that one indicated the respondent thought this statement was true with complete certainty, three being the respondent was unsure, and five being the respondent thought that this statement was false with complete certainty. Data are presented as mean ± SD. Wilcoxon rank sums test was used to assess statistics here.

and 84%) around the age of 55 ± 14 years, who had taken opioids before (68% and 76%), and took the survey on average 2 weeks post-op. There was a statistically significant difference in education level between groups. Specifically, the group that did not watch the video had proportionally more participants whose highest level of education was some form of postgraduate education (36% vs 8%) and high school (24% vs 16%). However, when we performed a sensitivity analysis and combined the participants with college and postgraduate education into one group ($n = 21$ video, $n = 19$ no video), the video and no video groups were similar.

Perceptions of pain management and opioid use post-CTR

Participants rated statements regarding pain and opioid use post-CTR as "true with complete certainty" to "false with complete certainty" on a scale from 1 to 5, and the results are presented in Table 2 (note: *n* dropped because of some participants not filling out portions of the survey). There were no differences between groups in the perceptions of pain and opioid use post-CTR based on these statements. Specifically, on average, both groups were not sure if they would experience immediate pain relief post-CTR. On average, both groups were relatively confident that almost all patients experienced relief post-CTR, that they knew what to expect going into their surgery, and that they were satisfied with their surgery. On the other hand, on average, both groups were relatively confident that opioids are not the best way to manage pain post-CTR, that opioids are not superior to nonopioids for managing pain post-CTR, and that there are risks associated with taking opioids post-CTR.

Table 3
Proportion of Patients Who Used Opioids to Manage Pain Post-Carpal Tunnel Release Surgery Among Patients Who did and Did Not Watch the Web Tutorial

Question	Watched Video ($n = 25$)	Did Not Watch Video ($n = 25$)	Statistical Value	*P* value
On your first post-op day, did you take any opioids after your carpal tunnel release surgery?	3 (12)	7 (28)	3.410	.182
During post-ops days 2–6, did you take any opioids after your carpal tunnel release surgery?	2 (8)	7 (28)	6.410	.043
During post-ops days 7–14, did you take any opioids after your carpal tunnel release surgery?	0 (0)	5 (20)	5.556	.018
Do you think that you are at risk of prolonged opioid usage?	0 (0)	1 (4)	2.000	.572

Data are presented as the number of patients (percentage of patients) that reported "yes" to the question. Chi-square tests were used to assess differences between the groups.

Proportion of patients using opioids to manage pain post-CTR

Participants report of whether they used opioids to manage pain on post-op days 1, 2–6, and 7–14 are shown in Table 3. There was no statistically significant difference in the proportion of patients who used opioids to manage pain between groups on post-op day 1. However, on post-op days 2–-6 (8% vs 28%) and 7–14 (0% vs 20%), the group that watched the video had a lower proportion of patients using opioids to manage pain than the group that did not watch the video. There was no significant difference in the perceived risk of prolonged opioid usage between groups, with both groups thinking they were not at risk (100% vs 96%).

Discussion

In this study, we assessed the effect of a web-based tutorial on perceptions of pain management and opioid usage and the proportion of patients who used opioids post-CTR. We found that the web-based tutorial did not result in significant differences in perceptions of pain management and opioid usage post-CTR, as quantified by our survey statements. However, we found that reported opioid usage beyond postoperative day 1 was significantly lower in the group that watched the web tutorial in comparison to the group that did not. This finding suggests that although the video did not necessarily further educate patients, it may have reminded the patients or made them more aware of this education during their recovery period.

One finding from this study is that the perceptions of pain management and opioid usage between the two groups did not appear different based on our survey questions. Encouragingly, most patients in both groups were aware of the risks of using opioids and the effectiveness of nonopioids with CTR pain, which is similar to previous reports.[18] However, there was a small, but important, minority of patients who thought that opioids were the best pain management after CTR (14%), superior to other pain management options (24%), and without significant, long-term risks (6%). Additionally, the vast majority of patients in this study thought that they were not at risk of long-term opioid usage (98%). Thus, there is still a need to improve awareness and education of patients undergoing CTR. Fortunately, previous studies suggest that patients are open to continued opioid-related education.[18,19]

Several studies have suggested that increased education on opioids and their detrimental side effects improves usage outcomes. For example, preoperative opioid counseling was found to reduce the average number of pills consumed per day from 2 to 0.5 without affecting patient-reported pain after CTR.[11] Similarly, educational handouts reduced the size of prescription consumption among patients from 11 to 3 pills.[10] Our findings are in line with these previous reports, with the web-based tutorial reducing the number of patients consuming opioids on post-op days 7–14 to 0 compared with 20% in the nontutorial group.

One novelty of our study was the development and usage of an evidence-based web tutorial. In a 2022 systematic review and meta-analysis, Grilo et al[13] found that educational videos are more effective and decrease patient anxiety to a higher degree than other educational materials, including handouts. Studies included in their review suggest that these improvements may be driven by (1) patients not reading or understanding handouts versus patients tend to adhere to and better understand the same content in video form,[20–22] (2) engaging other areas of patients learning (ie, Bloom's Taxonomy),[23] and (3) activating of the same cortical areas of the brain that are activated when the patient is performing the watched task[24–26] (ie, watching a video on pain management will activate the same area of the brain when the patient is deciding how to manage their pain). In a study aimed at understanding the role of video education for surgical training, London et al[27] found novice learners (eg, patients and resident physicians) retained more content when adequate background information and written outlines were provided, and we prioritized these items in our tutorial. Thus, we anticipate similar mechanisms may be dictating the behavioral changes we report here, although future studies are needed to confirm this speculation.

Although, to date, several general opioid use training modules for both health care providers[28] and the public[29] are available, and most institutions have training modules for their specific providers, to our knowledge, the published literature lacks tested web tutorials for guiding pain management for CTR. In addition to the aforementioned advantages of video education, patients are able to rewatch the video at any point while at home, and if further validated, a version of this web tutorial could more efficiently facilitate pain management discussions and ultimately save the health care team time. These are particular advantages, given the large reports of patients forgetting preoperative guidance once they are post-op.[30,31] Thus, although in this study, we focused on CTR, the structure of this study and implications of our findings could extend beyond CTR and perhaps even beyond orthopedic surgery if our findings are consistently repeatable.

Although this study adds to the growing body of literature aimed at reducing opioid usage and increasing patient education, it does have limitations. First, the video and survey were developed by the authors and were not vetted by patient education experts prior to use. If these tools are to be used in future studies or clinical practice largely, further validation is needed. All respondents were a part of the University of Pittsburgh health care system and under the care of a single surgeon (J.R.F.); thus, generalizability to other surgeons, regions, and hospitals is unclear. The patient respondents

were limited to a largely homogenous population (cisgendered women, White, and around the age of 50 years); thus, caution should be taken when extrapolating these results to other populations. Additionally, our survey collected demographic information; therefore, we do not know what demographics were missed in the 17 patients that were lost to follow-up. Highest level of education may have been a confounding variable in this study, although it is unclear if the difference between "college educated" and "postgraduate education" produced a clinically meaningful difference in this data set. This study was also limited by a relatively small sample size, 30% loss-to-follow-up, and large variability as to when in the postoperative period, the survey was completed; thus, there may be other relationships that exist that were not identified here. One of the primary outcome measures in this study was patient-reported opioid usage, which may be limited by recall bias, especially given the variability in response time (ie, 2 weeks ± 1 week).[32] Additionally, this metric was reported as a binary "yes/no," which limits conclusions that can be drawn and misses key information such as the dosage of opioid consumed.

Disclaimer

Given his role as Editor-in-Chief of *The Journal of Hand Surgery Global Online*, Dr. Fowler had no involvement in the peer-review of this article and has no access to information regarding its peer-review. Full responsibility for the editorial process for this article was delegated to Aviram M. Giladi, MD, MS.

Conflicts of Interest

No benefits in any form have been received or will be received related directly to this article.

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