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Pain Management Abstracts

Contents

Comparing cancer and non-cancer pain in artificial intelligence-generated imagery: a quantitative analysis

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52

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INTRODUCTION

With the introduction of artificial intelligence (AI) and machine learning technologies, particularly text-to-image generation models, there is a growing interest in how these tools portray complex human experiences such as pain.[1] AI-generated imagery offers a unique perspective on how pain is conceptualized and represented while also acting as a novel means of investigating societal perceptions and biases embedded within data used to train these models.[2] With the evolving role of AI in the delivery of health care, awareness of these biases is important for mitigating negative outcomes.[2] Despite pain historically being a presentation variably treated, in part due to prescriber bias, there is a paucity of research examining the depiction of pain in AI-generated images.[3,4] This study summarizes a quantitative analysis to uncover patterns and potential biases in AI-generated imagery of cancer and non-cancer pain using OpenAI's DALL-E 3, a free-to-use, publicly available model.

METHODS

A total of 2,000 images were generated using DALL-E 3.[5] The specific textual prompts used were "Person with cancer pain (realistic)" (1,000 images) and "Person with non-cancer pain (realistic)" (1,000 images). All generated images were initially reviewed for relevance and quality. Inclusion criteria required that images: 1) depicted at least one person, 2) were visually coherent without significant distortions or artifacts, and 3) reflected the theme as per the prompt. Images that failed to meet these criteria were excluded from further analysis. After applying the inclusion criteria, all qualifying images were included in the dataset without further filtering and were analyzed by two independent reviewers examining the following variables: sex, age, race, facial expressiveness, physical setting, and the number of additional people. The methodology for examining each variable was based on an objective, composite analysis of visual characteristics and contextual cues (Figure).

RESULTS

All generated images were included. The Table reports the results of the quantitative analysis. Unbalanced depictions of sex, age, and race were noted. In the DALL-E 3 model, cancer pain appeared to be depicted with more nuance, incorporating elements of support, varied emotional expression, and demographic diversity. In contrast, non-cancer pain was more narrowly framed as isolating, overwhelmingly negative, and disproportionately affecting older females. In both depictions of pain, non-Caucasian representation appeared less frequently than Caucasian representation.

DISCUSSION

AI-generated depictions of pain reveal biases that reinforce stereotypes, such as portraying cancer pain with support and positivity, while isolating and invalidating non-cancer pain. These images also underrepresent racial minorities, risking the perpetuation of "invisibility in illness" narratives and influencing clinical empathy and resource allocation.[2] By reflecting biases in their training data, AI models offer insights into inequities. Diversification of training datasets, collaboration with diverse stakeholders, and transparency in AI development tools are steps towards achieving inclusive and equitable technologies.

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Figure An example of a text-to-image artificial intelligence-generated depiction of cancer pain in OpenAI's DALL-E 3 model using the prompt, "Person with cancer (realistic)." The image would be characterized as: female sex, younger age, White race, positive facial expression, and 0 additional people.

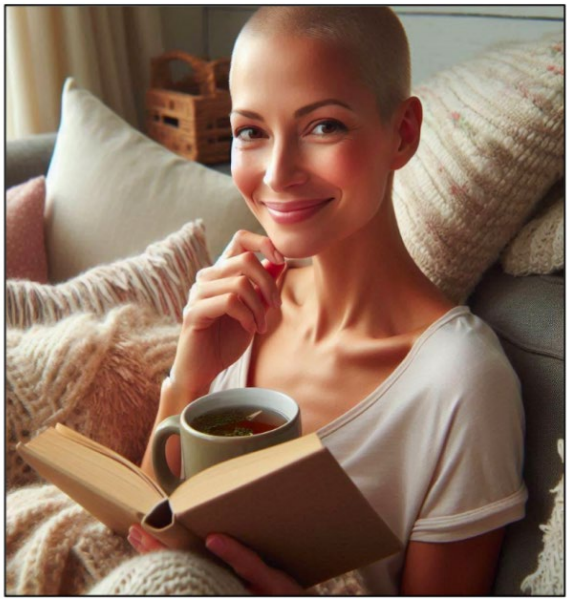

Table Results of a quantitative analysis performed on 2,000 depictions of pain when the prompts, "Person with cancer pain (realistic)" (*N* = 1,000) and "Person with non-cancer pain (realistic)" (*N* = 1,000) was inputted into OpenAI's DALL-E 3, a text-to-image generator

	Cancer Pain (N=1000)	Non-Cancer Pain (N=1000)
Sex, n (%)		
Male	441 (44.1)	332 (33.2)
Female	559 (55.9)	668 (66.8)
Age, n (%)		
Younger	426 (42.6)	331 (33.1)
Older	574 (57.4)	669 (66.9)
Race, n (%)		
White	633 (63.3)	558 (55.8)
Non-White	367 (36.7)	442 (44.2)
Facial Expression, n (%)		
Positive (i.e., smiling)	479 (47.9)	326 (32.6)
Negative (i.e., frowning)	521 (52.1)	674 (67.4)
Additional People, n (%)		
0	318 (31.8)	616 (61.6)
1	290 (29.0)	343 (34.3)
2	140 (14.0)	41 (4.1)
3	129 (12.9)	0 (0)
4	64 (6.4)	0 (0)
5+	59 (5.9)	0 (0)

Evaluating the use of parasternal intercostal nerve blocks as adjunct pain control therapy for post-sternotomy cardiac surgical patients

Submission ID

61

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INTRODUCTION

Patients undergoing median sternotomy during cardiac surgery often experience significant discomfort during recovery despite best efforts to achieve optimum pain control.[1] Historically, this has relied heavily on opioids, which while effective, are associated with adverse effects such as somnolence, nausea, and an increased risk of long-term opioid use.[2] To address these negative effects, a recent emphasis has been placed on multimodal analgesia, a cornerstone of Enhanced Recovery After Surgery (ERAS) protocols.[3] Specifically, ultrasound-guided parasternal intercostal nerve blocks are a novel intervention being implemented by anesthesiologists to manage breakthrough pain.[4] Though there is literature demonstrating that these blocks may reduce opioid requirements and improve patient outcomes, the evidence is still emerging.[4] This quality improvement project aimed to evaluate the efficacy of parasternal nerve blocks by assessing patient-reported pain scores and opioid consumption, with the goal of informing future pain management pathways for cardiac surgery patients.

METHODS

Following Institutional Ethical Committee approval for the quality improvement project, a prospective observational study was completed to evaluate the effectiveness of the parasternal nerve block for postoperative pain control. Between February and December 2024, the study enrolled 46 patients who had received the sternal block, 32 of which completed a survey during their hospital stay. Pain scores were self-reported using a visual analog scale from 0–10 before and after the intervention. Additional survey data captured patient-perceived benefits and the duration of pain relief. Opioid consumption (in morphine milligram equivalents [MMEs]) was assessed for all 46 patients via chart review at four time points: 6 hr prior to the block, and at 6, 12, and 24 hr after. Due to the non-normal distribution of the data, the Wilcoxon Signed-Rank Test was used to analyze paired changes in pain scores and opioid requirements. Z-scores and *P* values were used to evaluate statistical significance.

RESULTS

Analysis using the Wilcoxon Signed-Rank Test demonstrated significant reductions in both pain scores and opioid use following the parasternal nerve block. The median decrease in opioid consumption was 18.5 mg morphine milligram equivalents (MMEs) [IQR, 6.0–26.25 mg], with a statistically significant decrease observed ($Z = -5.041$; $P < 0.001$). Similarly, the median reduction in self-reported pain scores was 3.5 points [IQR, 2.0–5.75], also demonstrating a significant improvement ($Z = -4.117$; $P < 0.001$). Survey responses showed that 84.4% of participants perceived a decrease in pain and improvement in breathing following the procedure. Additionally, 58.6% reported that pain relief lasted longer than 6 hr, and 62.5% strongly agreed they would undergo the procedure again for these benefits. There were no complications associated with the block observed during the study period. These findings underscore the effectiveness of parasternal nerve blocks in reducing postoperative pain and opioid use.

DISCUSSION

This quality improvement project highlights the effectiveness of the parasternal nerve block in reducing postoperative pain and opioid use following median sternotomy. The clinical utility of this intervention was demonstrated by the significant reductions in pain scores and opioid requirements, combined with high patient satisfaction and reported duration of pain relief. These findings support the integration of parasternal nerve blocks into routine practice, particularly as part of the ERAS protocols aimed at improving recovery and minimizing opioid reliance. We hope to use this information to develop further and refine this patient population's postoperative pain management pathway.

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Peripheral magnetic stimulation as a novel treatment modality for fibromyalgia: a case series

Submission ID

54

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INTRODUCTION

Fibromyalgia is a common pain disorder affecting 2% to 8% of the general population, with a higher incidence in women compared to men.[1] It is a complex syndrome marked by widespread pain due to chronic central nervous system hyperexcitability, amplifying pain perception even from non-painful stimuli.[2] Current treatment options are often limited by lack of efficacy and side effects, including the risks of addiction and overdose associated with opioid medications. Occipital nerve stimulation has shown promise in alleviating fibromyalgia symptoms through the use of implantable peripheral nerve stimulators.[3] Repetitive peripheral magnetic stimulation (rPMS) is emerging as a noninvasive modality to stimulate peripheral nerves. This technique has demonstrated significant pain reduction in conditions such as complex regional pain syndrome, chronic low back pain,[4] and glossopharyngeal neuralgia.[5] This case series evaluated the safety and effectiveness of rPMS using intermittent theta burst stimulation of the bilateral occipital nerves in patients with fibromyalgia.

CASE PRESENTATION

Five female fibromyalgia patients (mean age, 61 ± 11.9 yr) underwent rPMS treatment using the Magstim Rapid 2 device at 25% power. The protocol consisted of 120 cycles of 10 sec each, delivering a total of 3,600 pulses over 20 min to each greater occipital nerve, for a total treatment time of 40 min. The Brief Pain Inventory and Short Form-12 Health Survey were administered at baseline, as well as at 1-week and 1-month post-treatment. Pain scores on a 0–10 scale decreased significantly from 7.2 ± 2.68 at baseline to 6.25 ± 3.30 at the 1-week follow-up (P = 0.039). Pain interference with general activities improved significantly from 6.6 ± 2.61 at baseline to 4.75 ± 4.27 at the 1-week follow-up (P = 0.033). Similarly, pain interference with work (including housework and external work) decreased from 6.8 ± 2.59 at baseline to 4.5 ± 4.80 at the 1-week follow-up (P = 0.040). No significant improvements were observed at the 1-month follow-up.

CONCLUSION

This case series of occipital nerve stimulation using rPMS provides preliminary evidence on the potential of this novel therapy in the treatment of fibromyalgia. Our results suggest significant short-term improvements in pain scores and function with this non-invasive option. While we did not identify sustained benefits at the 1-month follow-up, further research is needed to identify optimal treatment protocols, stimulation parameters, and re-dosing regimens to determine if benefits could be sustained over time. Additionally, larger placebo-blinded controlled studies are urgently needed to determine whether this innovative treatment option can bridge existing gaps in fibromyalgia pain management and improve patient outcomes.

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Peripheral magnetic stimulation for the treatment of fibromyalgia: a meta-analysis of the literature

Submission ID

24

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INTRODUCTION

Fibromyalgia (FM) is a chronic condition characterized by widespread pain, cognitive impairments, and emotional challenges, with an unclear pathophysiology. It imposes significant economic burdens, costing the USA $12–14 billion annually. Predominantly affecting women (70.7%), FM is managed through pharmacological treatments like antidepressants, pregabalin, and duloxetine, and non-pharmacological therapies such as exercise and education. However, many treatments provide only modest pain relief, emphasizing the need for innovative solutions.

Peripheral magnetic stimulation (PMS), a type of pulsed electromagnetic field therapy, has emerged as a potential adjunctive therapy for FM.[1] Peripheral magnetic stimulation utilizes low-frequency magnetic fields to influence inflammatory, cellular, and neurological processes, potentially interrupting pain pathways and improving symptoms. This systematic review aims to evaluate the benefits and risks of PMS in FM management, hypothesizing that PMS offers moderate pain relief with minimal adverse effects, contributing to a multimodal approach to FM care.

METHODS

This systematic review and meta-analysis followed PRISMA guidelines and Cochrane methodology. The protocol was registered in PROSPERO (CRD42021235164). A comprehensive search of six databases through July 2023 used keywords like “peripheral magnetic stimulation” and “fibromyalgia,” with studies limited to English and excluding transcranial magnetic stimulation. Studies were selected based on the PICOS framework, targeting adult FM patients

treated with PMS, reporting pain and functional outcomes, and inclusive of various study designs. Title, abstract, and full-text screening were conducted by four reviewers, with conflicts resolved by a senior author.

Data extraction was performed independently using a standardized form, capturing study characteristics, PMS regimens, outcomes (e.g., visual analogue scale, fibromyalgia impact questionnaire, short form-36), and adverse events. Risk of bias for randomized controlled trials (RCTs) was assessed using Cochrane criteria, and evidence quality was graded using GRADE.

Pain outcomes were analyzed qualitatively and quantitatively, with self-reported measures converted to a standardized 0–10 numeric rating scale. Meta-analysis employed a random-effects model using RevMan 5.3, pooling data for outcomes at various timepoints. Statistical heterogeneity was assessed using the I^2 statistic. Secondary outcomes like quality of life and functional scores were included if data sufficed. Authors were contacted for missing data, and imputation was performed when variances were unavailable. Statistical significance was set at $P < 0.05$.

RESULTS

We initially identified 9,578 citations, ultimately including 6 RCTs in the meta-analysis. Three studies had high-risk bias, while three exhibited low-risk, resulting in low-to-medium overall trial quality. Published between 2007 and 2018 across six countries, the trials involved 279 patients and tested various PMS devices with magnetic field intensities ranging from 400 nT to 400 µT over 3 to 84 days.

Three studies showed significant pain relief with low-frequency PMS compared to sham controls, while two reported no clinically meaningful differences.[2–5] One study indicated potential placebo effects. Meta-analysis revealed a clinically significant reduction in pain scores within 1–3 months (mean difference, −1.86; $P = 0.0002$), but not beyond three months or for functional outcomes. No major adverse events were reported, although two cases of orthostatic hypotension resolved post-treatment. Findings suggest PMS is a safe yet inconsistently effective option for managing chronic pain in FM patients.

DISCUSSION

Our systematic review explored PMS for FM treatment, finding short-term analgesic effects lasting 1–3 months post-treatment (Figure). Strengths include a comprehensive search, inclusion of randomized, double-blinded, sham-controlled studies, and mixed qualitative-quantitative assessment. Heterogeneity in PMS parameters (intensity, frequency) complicates standardization. High dropout rates highlight adherence challenges in chronic pain studies. Limitations include sparse, small-sample RCT data and high heterogeneity, impacting generalizability. While current benefits are transient, PMS may become clinically valuable with improved protocols and longer-lasting effects. Future research should focus on optimizing regimens, enhancing adherence, and integrating PMS within multimodal treatments to empower patients and reduce health care costs.

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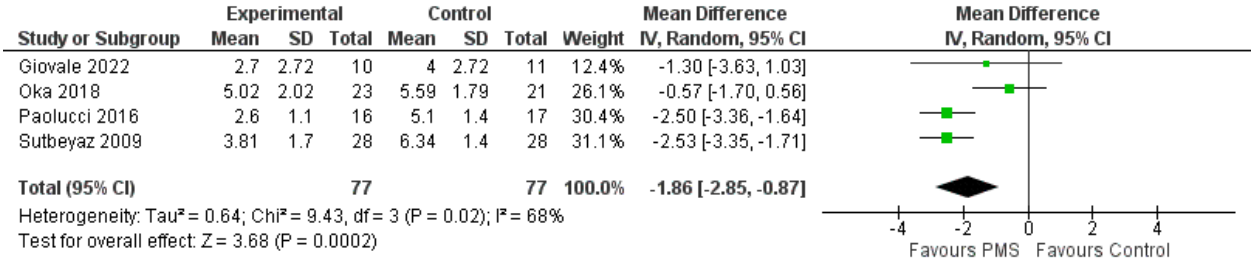
Figure Pooled effects of pain scores from 1–3 months of peripheral magnetic stimulation use compared to sham



Scalp block for management of posttransverse venous sinus stenting headache: a case report

Submission ID

59

AUTHORS

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INTRODUCTION

Idiopathic intracranial hypertension (IIH) mostly commonly occurs among women of childbearing age.[1] Symptoms include headaches, vision changes, and disabling pulsatile tinnitus (PT). Transverse sinus (TS) stenosis is a common pathology in IIH.[2] Venous sinus stenting (VSS) is a promising minimally invasive treatment option for patients with IIH and PT who are refractory to medical management.[2,3]

Post-stenting headache is a common side effect of VSS, occurring in 20–100% cases.[3] It is typically described as ipsilateral to the side of the stent, moderate and oppressive in intensity, and more common in the temple or occipital region. Scalp blocks have been used for management of other causes of headaches such as migraines, but not for VSS.[4,5]

We describe the experience of a 39-yr-old female patient who underwent multiple VSS for IIH and the use of scalp blocks to reduce the severity of post-stenting headaches. The patient provided written consent for this case report.

CASE PRESENTATION

The patient had a history of IIH causing bilateral PT and papilledema unresponsive to medical management. Imaging revealed bilateral narrowing of the TS. The patient first underwent right TS stenting. Immediately post-procedure, she developed a headache that she described as being very severe. This headache persisted with fluctuating yet severe intensity for 3 months, causing significant distress and requiring time off from work and treatment with Tylenol #3s. The patient returned twice more for PT recurrence. During the second procedure, angiography showed new stenosis of the right TS proximal to the previous stent and a pressure gradient. A second right TS stent was placed and successfully reopened the stenosis. During the third procedure, a left TS stent was placed.

The patient was offered scalp blocks for these two procedures. After induction and under aseptic technique, a mixture of ropivacaine 0.5% with 2.5 $\mu g \cdot mL^{-1}$ epinephrine and 2 $\mu g \cdot mL^{-1}$ dexmedetomidine was injected along the supratrochlear, supraorbital, zygomaticotemporal and auriculotemporal nerves ipsilateral to the expected site of stent

insertion. Bilateral greater and lesser occipital injections were also performed. A total of 34 mL and 23 mL of the local solution were used for each scalp block. Dexamethasone 8 mg *iv* was given for block prolongation.

The patient reported a significant difference in post-VSS headache following these 2 procedures. The scalp block lasted for approximately 30 hr in both instances. Thereafter, she experienced a short-lived mild headache not requiring analgesics. Compared to her initial procedure, she described her recovery post-VSS as “night and day.”

CONCLUSION

Post-VSS headaches occur very commonly and can be distressing. The purpose of this case report is to describe the analgesic efficacy of a scalp block in a patient who underwent multiple transverse VSS. The described patient reported a significantly improved post-stenting experience after receiving prophylactic scalp block for two of her procedures. Our technique, which included the addition of dexmedetomidine in the local solution and IV dexamethasone, resulted in a long-lasting block. Further investigation of post-VSS pain trajectories and clinical trials are required to better understand the role of scalp blocks for prevention of severe headaches in patients undergoing VSS.

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The METEOR study: a population-based cross-sectional analysis of extended-release opioid prescribing incidence, prognostic factors, and variation after total joint arthroplasty

Submission ID

23

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INTRODUCTION

Severe postoperative pain affects up to 40% of surgical patients, often requiring opioid therapy.[1] While opioids are effective for pain management, their long-term harms are well documented.[2] Extended-release opioids (ERO), commonly used for chronic pain, are increasingly prescribed for acute postoperative pain,[3] however, EROs carry potential risks, including higher rates of overdose and persistent opioid use.[4] Despite guidelines advising against EROs for acute pain,[5] data on ERO use in the perioperative period are limited and poorly described. To advance our understanding of ERO prescribing patterns, we conducted a population-based cohort study of patients undergoing hip and knee arthroplasty. Our specific objectives were to estimate the incidence of new postoperative ERO prescriptions, describe patient and perioperative factors associated with new ERO prescriptions, and explore variation in ERO prescribing practices at the patient-, provider-, and hospital-levels.

METHODS

Research ethics review was waived per provincial legislation, as the data were routinely collected for health system evaluation. We conducted a cross-sectional, population based historical observational study in Ontario, Canada. A protocol was prespecified and registered. We identified all Ontario residents aged > 18 who underwent their first inpatient, elective total hip or knee arthroplasty (THA or TKA) from 1 January 2013 to 31 March 2022. Participants were excluded if they filled a prescription for an ERO or mixed opioid agonist/antagonist in the 6 months prior to surgery. The analytic data set was constructed from patient-level deterministic linkage of the Discharge Abstract Database (to identify surgeries), the Narcotics Monitoring System (to identify all opioid prescriptions), and others. The primary outcome was receipt of an ERO prescription within seven days post-discharge. Secondary outcomes included persistent postoperative opioid use. The incidence of new ERO prescriptions was estimated with binomial 95% confidence intervals. Multilevel, multivariable regression was used to identify patient and

hospitalization factors predictive of receipt of a new ERO prescription. Random intercepts from multilevel models were used to estimate variance partition coefficients (VPCs) and median odds ratios (MOR), which quantify ERO prescribing variation between hospital- and provider-levels. A two-sided alpha = 0.05 was used.

RESULTS

Of the 258,624 who underwent THA or TKA from 2013 to 2022, 31,224 (12.1%) filled a new post-discharge ERO prescription. No temporal trend was identified. Extended-release opioids recipients had lower daily opioid doses (46.8 mg *vs* 60.5 mg oral morphine equivalents) in the first 90 days. Significant patient-level predictors of ERO receipt included younger age, lower frailty scores, lower American Society of Anesthesiologists Physical Status score, male sex, TKA (*vs* THA), and uncomplicated diabetes. Receipt of neuraxial anesthesia, peripheral nerve blocks and acute pain service care were hospitalization factors associated with lower odds of receiving an ERO. Variation in ERO prescribing was mostly attributable to the hospital (VPC = 44.4%). Patient characteristics and operative surgeon explained 29.1% and 25.5% of variation, respectively. Anesthesiologists accounted for only 1.0% variation (Figure). Adequate discrimination of personalized ERO-prescribing risk was possible only when accounting for hospital and surgeon random intercepts (validation c-statistic 0.91 [patient + random effects] *vs* 0.62 [patient effects only]).

DISCUSSION

Following THA or TKA in Ontario, more than 10% of patients receive a new ERO prescription, with substantial variation between hospitals and surgeons. While some patient- and hospitalization characteristics are associated with new ERO receipt, accurate discrimination between high- and low-risk patients is only possible when accounting for hospital and surgeon effects. These data suggest that efforts to reduce ERO prescribing will likely need to focus on practice patterns, including hospital and surgeon culture. Future research will estimate the association of new ERO prescription receipt with long-term outcomes to further quantify possible adverse outcomes of ERO prescribing.

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Figure Median odds ratios for adjusted and unadjusted variables based on random intercepts from multilevel models predicting receipt of a prescription for an extended-release opioid following total hip or knee arthroplasty