

Short Communication

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A multidisciplinary transitional pain service to improve pain outcomes following trauma surgery: a preliminary report

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Abstract

Objectives: Trauma (i.e., musculoskeletal injury from a blunt or penetrating force) can change the trajectory of a person's life. Patients often experience chronic pain, reduced quality of life, long-term opioid therapy, and psychiatric comorbidities after trauma surgery. This case report presents clinical outcomes of four patients who received postsurgical pain care in a transitional pain service (TPS) that provides long-term coordinated multimodal pain care, opioid tapering plans, and psychiatric care.

Methods: The Personalized Pain Program (PPP) measures prescription opioid use and patient-reported outcomes: pain

severity and pain interference (Brief Pain Inventory), pain catastrophizing (Pain Catastrophizing Scale), insomnia severity (Insomnia Severity Index), physical and mental health functioning (SF-12 pre-COVID-19; SF-36 during COVID-19 pandemic) at initial and subsequent clinic visits.

Results: All four patients reduced their postsurgical opioid use with concurrent reductions in pain and improved functioning while receiving postoperative care in the PPP (average length of treatment: 2.8 years). Psychiatric co-treatment addressed the onset or exacerbation of mental health comorbidities following trauma.

Conclusions: Long-term multidisciplinary pain care may improve post-trauma recovery and reduce risks of long-term opioid therapy and disability. Prospective studies are needed to evaluate the effectiveness of TPSs for patients undergoing trauma surgery.

Keywords: multidisciplinary; opioids; perioperative pain; trauma surgery.

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Introduction

Trauma (i.e., musculoskeletal injury from a blunt or penetrating force) can change the trajectory of a person's life. Optimal pain management is essential for post-trauma recovery. Surgical trauma patients often experience chronic pain, reduced quality of life, work absenteeism, and psychiatric comorbidities [1–3]. Approximately 95% of patients receive opioid prescriptions at discharge following trauma surgery [4] with nearly two-thirds of patients remaining on long-term opioid therapy (LTOT) [5] partly due to siloed and poorly coordinated postoperative pain care [6]. Non-surgical factors including pre-injury opioid use, income level, nicotine use, catastrophic thinking, anxiety, and antidepressant use increase the risk of LTOT [7–10]. The bidirectional relationship between physical trauma and mental health is well-established: trauma

can precipitate or exacerbate psychiatric comorbidities (e.g., major depressive disorder (MDD), anxiety disorders, substance use disorders (SUDs), posttraumatic stress disorder) and these comorbidities impact long-term pain and function [1, 11]. Additionally, patients who experience trauma face racial and ethnic disparities in access to acute and chronic care [12] with robust evidence demonstrating that race and insurance status are independently associated with disparate mortality and morbidity outcomes after trauma [12]. Recognizing chasms in postoperative pain management, multidisciplinary transitional pain services (TPSs) aim to provide long-term multimodal pain care, facilitate opioid tapering, and manage pain-related comorbidities following surgery [13–18]. No study has described the clinical course of patients who access TPSs after trauma surgery. We present four cases of patients of diverse backgrounds with different injury types who were treated in the Personalized Pain Program (PPP), a TPS based in a tertiary care academic center that opened in 2017 to provide coordinated multimodal pain care, opioid tapering plans, and psychiatric care for surgical patients in the ambulatory setting [13].

Methods

The concept and workflow of the PPP have been previously described [13, 19]. Briefly, during post-trauma hospitalization the surgical team consulted the Acute Pain Service (APS), which comprised anesthesiologists who used regional anesthesia techniques and provided multimodal analgesic recommendations. Patients were referred to the PPP by the surgical or APS teams. After hospital discharge, the PPP focused on setting realistic pain expectations, optimized multimodal analgesia, and tapered opioids. Psychiatric care included optimization of psychotropics and individualized supportive psychotherapy and cognitive behavioral-based interventions. This study was approved by the Institutional Review Board (IRB); patients consented to this case report.

Opioid consumption. During each PPP visit, a clinician reviewed opioid prescriptions in the electronic medical record (EMR) and Maryland prescription drug monitoring program, and any illicit use. Average daily opioid consumption was converted to morphine milligram equivalents (MME) and recorded in the EMR [19], which was manually extracted into the research dataset.

Patient surveys. As routine clinical practice, all PPP patients were emailed a link to an electronic survey through either Qualtrics or REDCap one day before their clinic visit. If patients did not complete the survey in advance, they completed it during their PPP appointment. From October 2017 through March 2020 patients completed surveys at each visit; in response to the COVID-19 pandemic the PPP transitioned to telemedicine in March 2020; to minimize patient burden, frequency of survey completion was reduced to the first PPP visit, one-month follow-up, and every 2 months thereafter.

Pain severity. The Brief Pain Inventory (BPI) pain severity (PS) subscale [20] consists of four averaged pain items (worst, least, average, and now) rated on a 11-point Likert scale ranging from

0 (no pain; no interference) to 10 (pain as bad as you can imagine; interferes completely).

Pain interference. The BPI pain interference (PI) subscale [20] consists of 7 averaged items that measure how much pain has interfered with daily activities (general activity, walking, work, mood, enjoyment of life, relations with others, and sleep); each item is rated on a 11-point Likert scale ranging from 0 (no pain; no interference) to 10 (pain as bad as you can imagine; interferes completely). The PI and PS subscales are presented separately as each domain represents a clinically important outcome that is critical to determine if chronic pain treatment is effective [21].

Pain catastrophizing. The Pain Catastrophizing Scale (PCS) [22] consists of 13 items rated on a 5-point Likert scale ranging from 0 (not at all) to 4 (all the time) which assess three dimensions of pain catastrophizing: rumination, magnification, and helplessness (Tables 1 and 2).

Insomnia. The Insomnia Severity Index (ISI) [23] consists of 7 items rated on a 5-point Likert scale ranging from 0 (none) to 4 (very severe) to assess the nature, severity, and impact of insomnia.

General physical and mental health functional status were measured with the physical (PCS) and mental component scales (MCS) of the 12-Item Short-Form Health Survey (SF-12v2) from October 2017 through March 2020. SF-12 is reported as Z-scores (difference compared to the population average); the United States population average is 50 with a standard deviation of 10. The PPP had a license with Optum (Eden Prairie, MN) to administer the SF12v2 via the website, <https://www.amihealthy.com/>, which patients accessed on a tablet provided during clinic visits. Since patients were unable to access the website during telemedicine visits, as of March 2020 the PPP transitioned to the RAND 36-Item Health Survey (SF-36 v2), administered via REDCap as described above. The scoring algorithm provides raw scores on a scale of 0–100. Higher scores represent better health status for both the SF-12 and SF-36 [24] (Table 1).

Results

For each patient, the type of trauma injury, trauma surgery, length of post-operative hospitalization, reason for PPP

Table 1: List of abbreviations and associated colors in Figure 1.

	Abbreviations	Color (Figure 1)
Morphine milligram equivalents	MME	Black
Brief pain inventory	BPI	
Pain severity	PS	Dark purple
Pain interference	PI	Light purple (dashed line)
Pain catastrophizing scale	PCS	Cyan
Insomnia severity index	ISI	Green
12-Item short-form health survey	SF-12	Solid bar
RAND 36-item health survey	SF-36	Dotted bar
Physical composite score	SF-PCS	Blue
Mental composite score	SF-MCS	Orange

Table 2: Patient trauma history and prescription opioid use, including during treatment in the personalized pain program (PPP).

Patient	Trauma injury	Trauma surgery	Post-trauma length of stay (days)	Reason for PPP referral	PPP treatment (days)	# PPP visits	Average daily prescription opioid use (MME)							
							P-trauma	Hospital discharge	1st PPP visit	3-month follow up	6-month follow up	12-month follow up	24-month follow up	PPP-discharge (or last visit) ^a
1	Left shoulder stabbing	Left shoulder foreign body removal, irrigation, and debridement	1	Orthopedic surgeon referred patient to optimize and assist with pain management; patient has a history of substance use and anxiety	931	38	7.5 mg	45 mg	90 mg	30 mg	70 mg	45 mg	68 mg	45 mg
2	Left thumb and index finger amputation	Left thumb reimplantation, index finger debridement, ORIF, laceration repair	22	Plastic surgeon referred to facilitate opioid taper; patient has history of OUD	1,596	34	0 mg	525 mg	290 mg	0 mg	2.5 mg	0 mg	0 mg	0 mg ^a + 16 mg buprenorphine
3	Gunshot wound	Right elbow ORIF	11	Orthopedic surgeon referred patient to optimize and assist with pain management	1,260	45	0 mg	135 mg	180 mg	45 mg	150 mg	30 mg	15 mg	0 mg
4	Mechanical fall	Closed fracture of left tibia and fibula	2	Orthopedic surgeon referred patient to optimize and assist with pain management	322	12	0 mg	45 mg	30 mg	20 mg	15 mg	15 mg	NA	30 mg ^a

MME, morphine milligram equivalents; ORIF, open reduction and internal fixation; ^apatient still in PPP at time of manuscript submission.

referral, PPP treatment duration and number of visits, and MME doses during PPP treatment are presented in Table 2.

Patient 1 is a 32-year-old, single Black unemployed male with a history of cannabis use disorder, anxiety, and a nonsteroidal anti-inflammatory (NSAID) allergy who underwent left shoulder foreign body removal following multiple knife stabbings. A PPP provider prescribed a multimodal regimen of acetaminophen, pregabalin, and duloxetine, and began oxycodone taper. Four months after intake he required arthroscopic debridement of his shoulder. Due to anxiety, he began psychiatry co-treatment at his 6th visit and was diagnosed with MDD. Duloxetine was cross tapered to mirtazapine. His depression remitted. He tapered opioids (Figure 1, panel A) and reduced marijuana from 10 to one joint daily. His pain, catastrophizing, insomnia, and mental health improved (Figure 1, panels A and B). He started dating and opened his own business. Eighteen months after his PPP intake, he underwent an ambulatory arthroscopic reoperation for rotator cuff repair. His opioid use transiently increased.

Patient 2 is a 40-year-old, single Caucasian male employed as a contractor with a history of cigarette smoking and opioid use disorder (OUD) in remission for seven years. He underwent thumb reimplantation and reconstructive surgery of his left hand following a circular saw injury. He feared OUD relapse and requested a rapid opioid taper to discontinuation. A PPP provider prescribed a multimodal regimen of acetaminophen, ibuprofen, gabapentin, and amitriptyline. He began psychiatry co-treatment 3 months after his first PPP visit. He was diagnosed with insomnia disorder and amitriptyline was titrated. His pain, catastrophizing, insomnia and functioning improved (Figure 1, panels C and D). He passed his General Educational Development (GED) exam, resumed his contracting job, married, and became a father. Nine months after initial PPP discharge, he re-entered treatment following a left shoulder labrum repair surgery at an outside hospital. He relapsed on opioids and benzodiazepines. PPP provider prescribed buprenorphine for OUD treatment (Figure 1, panel C). He remains abstinent from illicit opioids and benzodiazepines per self-report and random urine toxicology tests.

Patient 3 is a 26-year-old married Arabic male employed in telecommunications who underwent a right elbow open reduction and internal fixation following a gunshot wound to the arm. A PPP provider prescribed a multimodal regimen of gabapentin, acetaminophen, celecoxib, lidocaine patch, and duloxetine. He had a one-time consultation with psychiatry six months into his PPP care due to his fear of OUD.

He received psychoeducation on OUD vs. physical dependence and was encouraged to continue his taper. He underwent multiple surgeries for hardware replacement one-, four-, and 30-months after his initial PPP visit requiring acute escalations of his postoperative opioid use. By discharge, he tapered oxycodone to discontinuation, reported improved pain catastrophizing, insomnia, and functioning (Figure 1, panels E and F), and resumed full-time employment.

Patient 4 is a 48-year-old widowed Caucasian female employed as a house cleaner with a remote history of cigarette smoking, alcohol use disorder in remission, and MDD with one prior suicide attempt. The patient underwent closed fracture of left tibia and fibula after a mechanical fall. A PPP provider prescribed a multimodal regimen of gabapentin and duloxetine and cross-tapered tramadol to oxycodone. She began psychiatry co-treatment 12 months after her PPP intake for worsening depressive symptoms. She was diagnosed with MDD, and duloxetine was titrated with improvements in her mood, self-worth, and her interpersonal relationships. She had a hardware removal procedure 13 months after her initial PPP visit with increase in opioids and pain catastrophizing. She continued oxycodone taper with concurrent improvements in pain, insomnia, and functioning (Figure 1, panels G and H).

Discussion

Physical trauma causes substantial burden to individuals and society. Many trauma survivors experience chronic pain, disability, work absenteeism, and increased risk of LTOT and psychiatric comorbidities. We present diverse patients with various premorbid health conditions and unique injuries who reduced opioid use with concurrent reductions in pain and improved physical functioning while receiving postoperative care in the PPP. Our cases also demonstrated capacity to resume employment and build personal relationships. To our knowledge, this is the first report focused on trauma surgery patients receiving care in a TPS. Our findings demonstrate that long-term multidisciplinary pain care (average PPP treatment was 2.8 years) may improve post-trauma recovery and may mitigate the risks compounded by re-operations, a common complication following trauma [25–27].

Psychiatric co-treatment helped to address the onset or exacerbation of mental health comorbidities following trauma. Access to mental health treatment after trauma is poor and psychiatric comorbidities are frequently

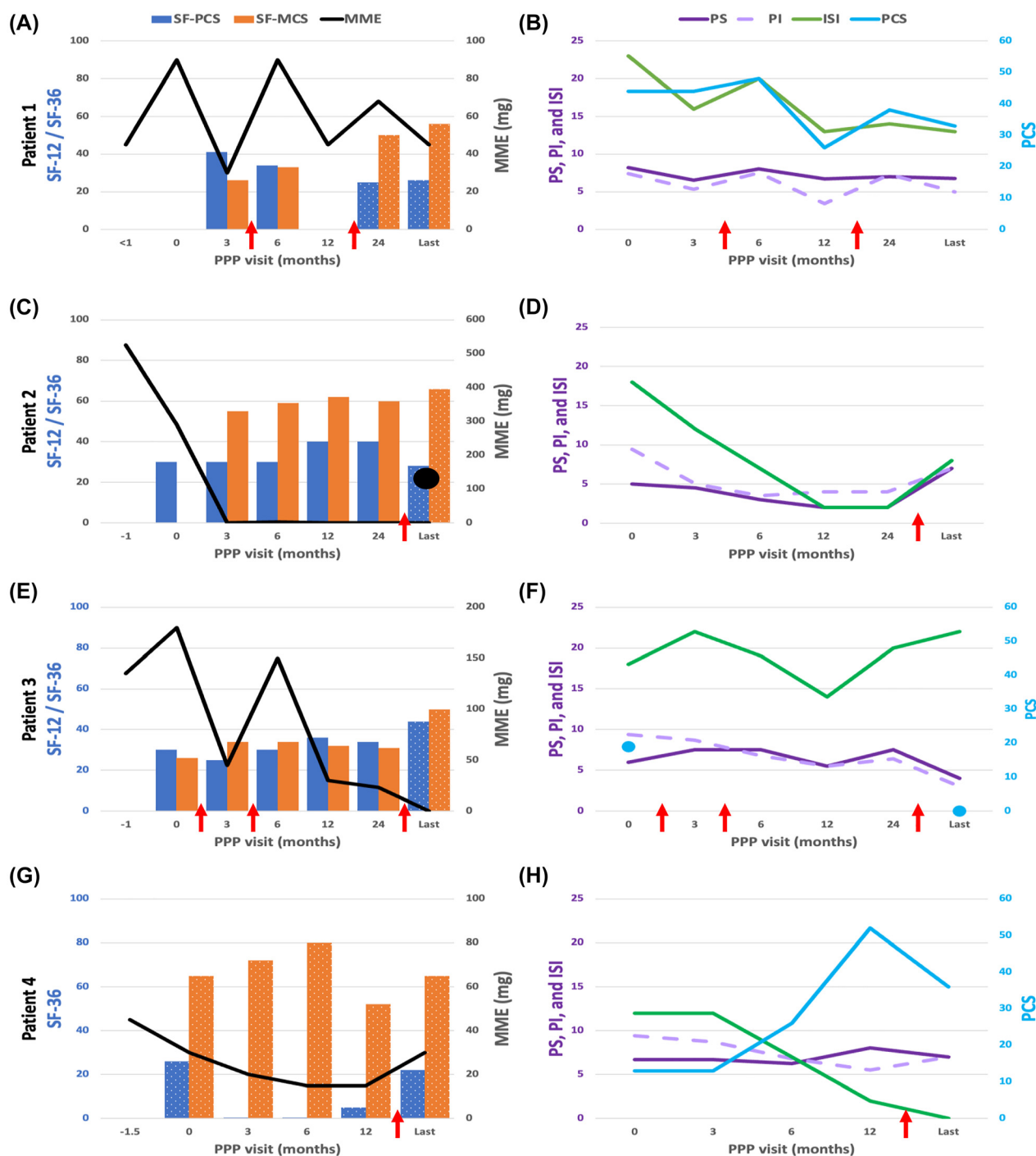


Figure 1: Long-term prescription opioid use (MME) from hospital discharge through last PPP visit and patient-reported outcomes among 4 patients who underwent trauma surgery and received postsurgical care in the PPP. Panels A and B represent Patient 1; Panels C and D represent Patient 2. The black dot in panel C indicates prescription buprenorphine (MME=120 mg); Panels E and F represent Patient 3; and Panels G and H represent Patient 4. Missing bar graphs or lines indicates missing data for that PPP visit. Red arrows indicate subsequent surgeries relative to the first PPP visit. As described in Methods, the PPP collected the SF-12 (solid bars) through March 26, 2020; when the PPP transitioned from in-person to telehealth visits due to the COVID-19 pandemic, it used the SF-36 (dotted bars), which could be administered virtually through REDCap. SF-12, 12-item short form health survey; SF-36, RAND 36-item health survey; SF-PCS, physical composite score (blue); SF-MCS, mental composite score (orange); PPP, personalized pain program; MME, morphine milligram equivalents (black); PS, pain severity (dark purple); PI, pain interference (light purple, dashed line); PCS, pain catastrophizing scale (cyan); ISI, insomnia severity index (green).

untreated or undertreated; the Lower Extremity Assessment Project, a large prospective study of patients who underwent orthopedic trauma revealed that less than one-quarter of patients received mental health care within two years of their injury [28]. Existing literature supports the value of integrated mental health care within orthopedic trauma centers for individuals, organizations and society [29–31]; yet several known barriers (e.g., scant knowledge on how to screen and make referrals for psychiatric conditions, limited organizational management support and resources) [6]. Our sample provides preliminary evidence that multidisciplinary specialty pain care may facilitate increased accessibility of mental health services for trauma patients.

This short communication has several limitations particularly the preliminary nature of the data. Second, these patients all received care at an academic tertiary medical center which has access to surgeons with subspecialty training in trauma and plastic and reconstructive surgery, anesthesiologists who specialize in regional and acute pain management, and psychiatrists with pain expertise; similar outcomes may not be generalizable across treatment settings. Finally, statistical analysis was not possible given the small number of patients. Thus, the results suggest trends in outcomes without further interpretation.

A crucial need exists to optimize patient access and delivery of pain care and improve clinical outcomes following trauma surgery. A worldwide trend is emerging to implement TPSs as an approach to improve care coordination and reduce risks of persistent postoperative pain and excessive postoperative opioid consumption. Our findings support the need for large prospective studies in diverse trauma populations to determine the success of TPSs on patient safety, healthcare quality, equity, and cost-effectiveness among this vulnerable population.

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Ethical approval: Research involving human subjects complied with all relevant national regulations, institutional policies and is in accordance with the tenets of the Helsinki Declaration (as amended in 2013) and has been approved by the authors' Institutional Review Board (IRB00230258).

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