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# Outpatient Shoulder Arthroplasty at an Ambulatory Surgery Center Using a Multimodal Pain Management Approach

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## Abstract

**Introduction:** Early reports of outpatient shoulder arthroplasty are promising, although a paucity of outcome data exists, particularly for the outpatient shoulder arthroplasty performed at a freestanding ambulatory surgery center (ASC).

**Methods:** A retrospective analysis of 61 shoulder arthroplasty procedures (21 consecutive outpatients and 40 inpatients) was performed. Outpatient shoulder arthroplasties were conducted at a freestanding ASC using a multimodal pain regimen without the use of regional anesthesia. The primary outcome was 90-day postoperative complication rate. Secondary outcomes included 90-day hospital admissions or readmissions, emergency department and urgent care visits, revision surgeries, mortality, postoperative pain, and functional scores.

**Results:** No major complications, readmissions, revision surgeries, or deaths occurred in the outpatient cohort. The rate of 90-day complications was 9.5% and 17.5% for the outpatient and inpatient cohorts, respectively. All patients who had their shoulder arthroplasty as an outpatient were discharged home the day of surgery. No complications related to the outpatient protocol were observed. However, 4.8% of those who had outpatient surgery visited an emergency department or urgent care within 90 days compared with 5.0% of those who had surgery as an inpatient.

**Discussion:** Outpatient shoulder arthroplasty can be performed safely and predictably in select patients at an ASC using a multimodal pain regimen without regional nerve block.

Total shoulder arthroplasty (TSA) and reverse TSA (RTSA) are effective procedures that restore function and provide long-term pain relief for conditions, such as glenohumeral osteoarthritis, inflammatory arthritis, osteonecrosis, proximal humerus

fractures, and rotator cuff arthropathy.<sup>1-3</sup> The demand for shoulder arthroplasty has increased at an average of 9.4% per year.<sup>4</sup> At the same time, the duration of hospital stay after TSA has decreased steadily as a result of improvements in surgical technique,

implant design, blood management, and multimodal pain control strategies.<sup>5,6</sup> The average hospital stay after TSA was approximately 10 days in the early 1990s, decreased to 3.1 to 3.9 days near the turn of the century, and has recently been reported to be 2.2 days.<sup>7,8</sup> Many uncomplicated primary TSAs are now discharged the day after surgery. The progression to shorter hospital stays, combined with the mounting pressures to lower health care costs, makes the idea of outpatient arthroplasty a logical consideration.

Outpatient total hip arthroplasty (THA) and total knee arthroplasty (TKA) are now well-established options in carefully selected patients.<sup>9-18</sup> These outpatient pathways have emphasized the importance of careful patient selection, multidisciplinary care coordination, patient education, standardized treatment protocols, early start times, and multimodal pain and nausea treatment strategies.

Outpatient shoulder arthroplasty, specifically performed in an ambulatory surgery center (ASC), is a relatively new concept with a few published studies in the literature. Very little is known about the preferred preoperative and postoperative pain regimen, patient selection criteria, surgical outcomes, and hospital readmission rates. Generally, TSA is thought to be a “safer” procedure than THA and TKA because of historically shorter hospital stays, fewer readmissions, and lower rates of blood transfusion, pulmonary embolism (PE), and mortality.<sup>19-21</sup> With the recent success of outpatient THA and TKA programs, it is reasonable to conclude that outpatient TSA could be equally or more successful.

The goal of the current study was to report 90-day outcomes from the first 21 consecutive shoulder arthroplasty procedures performed at a stand-alone ASC, focusing on patient complications, readmissions, and effectiveness of a multimodal pain control regimen.

## Methods

The first 20 patients (21 procedures) who underwent TSA or RTSA at a stand-alone ASC with 23-hour overnight observation capabilities were included (outpatient cohort). Procedures were performed by one of two orthopaedic surgeons fellowship-trained in shoulder and elbow surgery. In this study, surgeries performed as “outpatient” are defined as those with same-day discharge. Patients were selected for the outpatient pathway based on the overall health, including no history of significant cardiopulmonary disease, deep vein thrombosis (DVT), PE, or severe obstructive sleep apnea, the American Society of Anaesthesiologists (ASA) score of  $\leq 3$ , body mass index (BMI) of  $< 30$  (relative criteria), age  $< 65$  years, having no preoperative opioid dependence, having no walker or wheelchair dependence, having good social support at home, living within 1 hour from the surgery center, and being enthusiastic and motivated for the outpatient process. Additionally, non-Medicare insurance status was required because of the existing limitations of Medicare reimbursement for outpatient shoulder arthroplasty procedures performed at an ASC. Patient charts were retrospectively reviewed using an electronic medical record system, including surgical

reports, nursing and anesthesia notes, and all preoperative and postoperative clinic visits. Patients with incomplete 3-month clinical office follow-up were contacted by phone. The primary outcome was 90-day postoperative complications. Secondary outcomes included intraoperative complications, 90-day hospital readmissions, 90-day emergency department (ED)/urgent care (UC) visits, 90-day revision surgeries, 90-day mortality, and postoperative pain. Demographic information and clinical findings were recorded. Preoperative hemoglobin, ASA score, and calculation of age-adjusted Charlson comorbidity index (aCCI) were recorded for all patients. Preoperative American Shoulder and Elbow Surgery Shoulder Scores, Simple Shoulder Test scores, and Veterans RAND Item Health Surveys (VR-36, VR-12, and VR-6D) were included if available. Preoperative and postoperative patient-reported pain scores were captured at each clinic visit using a 0 to 10 visual analog scale (VAS).

Key components of the preoperative, intraoperative, and postoperative pathways are summarized in Table 1. Before surgery, a standard preoperative anesthesia evaluation was completed. Surgeries were scheduled for the first or second case of the day to allow for sufficient postoperative recovery time. No regional anesthetic blocks were performed for outpatient procedures given the concern for rebound pain after discharge. General anesthesia was used, and the surgery was performed in the beach chair position. A deltopectoral approach to the shoulder was used in all cases. Noncemented, press-fit

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Table 1

## Key Components of Outpatient Pathway

Preoperative	Intraoperative	Postoperative (PACU)	Home
Patient education	General anesthesia + fentanyl IV prn	Ice/sling	Home medications
Anesthesia evaluation	Beach chair, deltopectoral approach	PACU medications	Percocet 5 mg/325 mg PO q4-6 h prn
Early surgery start time	TXA 1 g IV	Dilaudid 0.3-0.5 mg IV q1h prn	Gabapentin
Preoperative medications (preoperative holding)	Toradol (first dose)	Oxycodone 10 mg PO q4h prn	Meloxicam
Scopolamine patch (to prevent nausea)	40 mL periarticular injection (Exparel/Marcaine)	Tylenol 1 g PO	Zofran 4 mg PO q6h prn
Zofran 4 mg IV	Hemovac drain placed	Toradol 30 mg IV q6h prn	Tylenol
Pepcid 20 mg/2 mL IV		ASA 325 mg PO w/first meal	Prescriptions filled in advance
Tylenol 1 g PO		Zofran 4 mg IV on PACU arrival, then q4h prn	Cryotherapy
Ancef versus vancomycin IV (weight-based dosing)		Phenergan 12.5 mg IV q6h prn if failure Zofran	Urgent care if unable to void
No regional block		Redose antibiotics	Nurse call POD 1 (pain, nausea, numbness/tingling, dressing)
		(Ancef 6 h versus vancomycin 8 h after initial dose)	Therapy begins POD 3
		Redose TXA 1 g IV	Clinic visits: 2 wk (w/x-ray), 6 wk, 3 mo, 1 yr
		Therapy consult (mobilization/teaching)	
		Straight cath prn	
		Hemovac drain removed before discharge	

IV = intravenous, PACU = Post Anesthesia Care Unit, PO = orally, prn = as needed

humeral components and cemented polyethylene glenoid components were used for all TSA procedures. Standard RTSA components were used for all RTSA procedures. The subscapularis tendon was reattached to the less tuberosity footprint if adequate tissue was available. At the conclusion of all arthroplasties, 40 mL of a 1:1 mixture of 1.3% liposomal bupivacaine (20 mL) and 0.25% bupivacaine hydrochloride and epinephrine (20 mL) was injected into the periarticular musculature, joint capsule, and subcutaneous tissue, as previously described by Angerame et al.<sup>22</sup>

In the Post Anesthesia Care Unit (PACU), patients met with an occupational therapist and were instructed in shoulder, elbow, and hand exercises, sling position, and sleeping position. Aldrete's scoring criteria, including respiratory status, oxygen status, circulatory status, level of consciousness, and activity, were evaluated before discharge. Patients could not be discharged with pain score greater than four or an intravenous narcotic medication provided within 1 hour before discharge. Postoperative pain medication prescriptions were provided to the patient in advance. Patients were

contacted on postoperative day 1 to assess for numbness/tingling (yes/no), pain (yes/no), nausea/vomiting (yes/no), and status of their dressing.

For purposes of comparison, we reported demographic and outcome data on 40 inpatient procedures (37 patients) treated with shoulder arthroplasty at a hospital-based inpatient surgery facility during the same period and performed by the same 2 surgeons (Inpatient cohort). Patients were prescreened based on surgery type, sex, age, and physician. Demographic information was reviewed from the charts, and the Inpatient cohort was further narrowed by excluding

patients because of insufficient follow-up, ASA score of  $\leq 3$ , revision surgery, concomitant latissimus dorsi transfer, hemiarthroplasty, supermorbidity, or participation in our institution's opioid-free study. After 40 inpatients were selected, outcomes were determined from a retrospective review of the patients' charts.

Wilcoxon rank sum tests were used to compare the nonparametric data between the groups. For categorical variables, a chi square or Fisher exact test was used. Analyses were performed using SAS version 9.4 (SAS Institute; <http://www.sas.com/software/sas9>).

## Results

Demographic comparison of the outpatient and inpatient cohorts is provided in Table 2, and the results are summarized in Table 3. Three patients in the outpatient cohort had incomplete 90-day follow-up; these patients were contacted by phone and queried about postoperative complications. No complications, readmissions, ED/UC visits, or revision surgeries were noted in these three patients. Most outpatient cohort ASA scores were of class II (66.7%), whereas most inpatient ASA scores were of class III (62.5%); these scores differed significantly between cohorts ( $P = 0.0302$ ). There were slightly lower rates of previous cardiac/pulmonary disease/cerebrovascular accidents (19.1% versus 35.0%), diabetes (15.0% versus 24.3%), and current smokers (10.0% versus 18.9%) in the outpatient cohort versus the inpatient cohort. Age, sex distribution, BMI, aCCI, preoperative hemoglobin, preoperative American Shoulder and Elbow Surgery, VR-12, and VR6D scores, surgical blood loss, surgical time, and distribution of anatomic TSA versus RTSA were otherwise similar between the 2 cohorts. Almost half (45.0%) of the

inpatient cohort underwent interscalene block compared with 9.5% of the outpatient cohort.

The median hospital stay for the inpatient cohort was 1 day; 85% were discharged on postoperative day 1, and all but one was discharged by postoperative day 2. One patient was discharged postoperative on day 4 because he or she lived alone and could not be safely discharged earlier. The average PACU time for the outpatient cohort was 5 hours 21 minutes. All outpatients were successfully discharged from the ASC the same day of surgery with no hospital transfers required. Forty percent of the outpatient cohort reported pain on postoperative day 1, 10% reported nausea and/or vomiting, and none reported tingling or numbness. No intraoperative complications, no revision surgeries, and no deaths occurred within 90 days in either group. Two patients (9.5%) in the outpatient cohort had minor complications within 90 days, including a fall 2 weeks postoperatively requiring an UC visit but sustaining no structural damage, and a partial brachial plexopathy, which substantially improved postoperatively but had residual numbness at 40 weeks. Seven patients (17.5%) in the inpatient cohort had complications within 90 days, including 1 major complication (a myocardial infarction occurring 6 weeks postoperatively requiring hospitalization and stent placement) and 6 minor complications (a transient axillary neurapraxia, a fall down stairs 1 week postoperatively requiring an ED visit but sustaining no structural damage, a transient brachial plexopathy, postoperative bigeminy and hypoxia requiring overnight ICU stay, a hospital readmission 2 weeks postoperatively for constipation and superior mesenteric vein thrombosis, and a fall down stairs 6 weeks postoperatively requiring an UC visit but sustaining no structural damage). Median postoperative VAS pain score

at 2 weeks was lower for the outpatient cohort, and this finding was statistically significant (VAS 2 versus 3;  $P$  value, 0.0441). Preoperative, 6 weeks postoperative, and 3-month postoperative pain scores showed no statistically significant difference.

## Discussion

Berger et al were the first to describe a successful outpatient total joint arthroplasty protocol, first in 2003 for THA and in 2005 for TKA.<sup>23,24</sup> Their "comprehensive outpatient pathway" used a multimodal pain control regimen, preoperative education, and early start times. Others have followed suit in the hip and knee literature with their own outpatient or fast-track pathways.<sup>5,9,10,14-18,25,26</sup> Several recent National Surgical Quality Improvement Program studies<sup>27,28</sup> and a 5% Medicare sample study<sup>29</sup> have demonstrated that outpatient THA and TKA can be performed successfully in carefully selected patients with no increase in readmissions.

In this study, we found outpatient shoulder arthroplasty to be a safe and predictable option for properly selected patients undergoing elective shoulder arthroplasty.

Outpatient shoulder arthroplasty was first described by Ilfeld et al<sup>30</sup> in 2005. Early outpatient shoulder arthroplasty studies incorporated the use of interscalene nerve blocks, heavy reliance on home health nursing, and careful patient selection.<sup>30,31</sup> Although low in patient numbers, these studies showed a few complications or hospital admissions and consistently high patient satisfaction. Brolin et al<sup>32</sup> were the first to demonstrate the efficacy and safety of outpatient TSA performed in a freestanding ASC. They retrospectively analyzed 90-day complications, hospital readmissions, and revision surgeries in 30 patients who underwent

Table 2

## Demographic Comparison of Outpatient and Inpatient Cohorts

Variable	Stratified by Cohort		P Value
	Outpatient (n = 21 Procedures)	Inpatient (n = 40 Procedures)	
Age at surgery (yr), median (IQR)	59.8 (57.0-61.8)	59.9 (55.9-62.8)	0.5116
Sex, n (%)			0.9929
Male	10 (50)	18 (48.7)	—
Female	10 (50)	19 (51.3)	—
BMI at surgery, mean (SD)	29.0 (7.2)	30.6 (7.3)	0.3958
ASA, n (%)			0.0302
II	14 (66.7)	15 (37.5)	—
III	7 (33.3)	25 (62.5)	—
Age-adjusted Charlson comorbidity index, n (%)			0.1456
0	1 (4.8)	0 (0)	—
1	6 (28.6)	13 (32.5)	—
2	11 (52.4)	11 (27.5)	—
3	3 (14.3)	11 (27.5)	—
4	0 (0)	4 (10.0)	—
5	0 (0)	1 (2.5)	—
Cardiac/pulmonary disease/CVA, n (%)	4 (19.1)	14 (35.0)	0.1943
Diabetic, n (%)	3 (15)	9 (24.3)	0.5124
Smoking status, n (%)			0.3801
Current	2 (10)	7 (18.9)	—
Former	7 (35)	9 (24.3)	—
Preoperative Hb, mean (SD)	13.7 (1.2)	13.9 (1.2)	0.5143
ASES, mean (SD)	37.7 (14.5)	33.6 (13.3)	0.4401
VR-12 Mental component, mean (SD)	53.6 (11.1)	54.0 (11.9)	0.9130
VR-12 Physical component, mean (SD)	36.3 (11.4)	34.3 (10.7)	0.6245
VR-6D, mean (SD)	0.6 (0.1)	0.6 (0.1)	0.7728
TSA, n (%)	12 (57.1)	22 (55.0)	0.9564
RTSA, n (%)	9 (42.9)	17 (42.5)	—
EBL (mL), median (range)	100 (50-200)	100 (100-200)	0.0679
Procedure time (min), mean (SD)	110.4 (22.0)	106.5 (25.0)	0.5411
Interscalene block, n (%)	2 (9.5)	18 (45.0)	0.0050

ASA = American Society of Anaesthesiologists, ASES = American Shoulder and Elbow Surgery, BMI = body mass index, CVA = cerebrovascular accidents, IQR = interquartile range, RTSA = reverse total shoulder arthroplasty, TSA = total shoulder arthroplasty

TSA at an ASC and compared them to an age- and comorbidities-matched cohort of 30 patients who underwent usual inpatient TSA. Average age of the ambulatory surgery cohort was 52.6 years. Pain control strategy included an intraoperative periarticular injection and a multimodal pain management regimen. No statistically significant difference in complication rates and no cardiopulmonary complications were

seen. The authors concluded that outpatient TSA is a safe procedure for carefully selected patients. We used a similar multimodal pain management regimen in our study. Our findings are similar to that of Brolin et al in that no statistically significant increase in complications, revision surgeries, or readmissions were observed compared with an inpatient cohort; all patients were discharged from the ASC the day

of surgery. Our outpatient cohort was 5.9 years older on average, but the outpatient complication rates were comparable (9.5% versus 13%).

A recent retrospective National Surgical Quality Improvement Program database review found 30-day adverse event rates of 2.3% and 7.9%, respectively, for outpatient TSA compared with inpatient TSA and readmission rates of 1.7% and

Table 3

## Summary of 90-Day Outcomes for Outpatient and Inpatient Cohorts

Variable	Stratified by Cohort		P Value
	Outpatient (n = 21 Procedures)	Inpatient (n = 40 Procedures)	
Hospital LOS nights, median (range)	NA	1.0 (1.0-4.0)	—
Intraoperative complication, n (%)	0 (0)	0 (0)	0.4785
Postoperative complication, n (%)	2 (9.5)	7 (17.5)	0.9999
Major complication, n (%)	0 (0)	1 (2.5)	—
Minor complication, n (%)	2 (9.5)	6 (15.0)	—
Hospital admission or readmission, n (%)	0 (0)	1 (2.5)	0.9999
ED/UC combined visit, n (%)	1 (4.8)	2 (5.0)	0.9999
ED visit, n (%)	0 (0)	2 (5.0)	0.5410
UC visit, n (%)	1 (4.8)	0 (0)	0.3443
Revision surgery, n (%)	0 (0)	0 (0)	—
Mortality, n (%)	0 (0)	0 (0)	—
Preoperative pain VAS, median (range)	8.0 (0.0-10.0)	6.0 (2.0-10.0)	0.2517
Postoperative pain 2 wk, median (range)	2.0 (0.0-8.0)	3.0 (0.0-9.0)	0.0441
Postoperative pain 6 wk, median (range)	2.0 (0.0-8.0)	2.0 (0.0-9.0)	0.5153
Postoperative pain 3 mo, median (range)	1.0 (0.0-8.0)	2.0 (0.0-6.0)	0.1999

ED = emergency department, LOS = length of stay, UC = urgent care, VAS = visual analog scale

2.9%, respectively.<sup>21</sup> When patient and procedure characteristics were matched between the two groups, no significant differences in 30-day adverse events or readmission rates were found. The authors also concluded that outpatient TSA was safe and cost-effective in the appropriately selected patient.

The rates of 30-day complications, major morbidity, and death in general inpatient shoulder arthroplasty are 8%, 2%, and 0.26%, respectively.<sup>33</sup> Waterman et al<sup>34</sup> demonstrated that peripheral vascular disease, increased surgical time, and corticosteroid use were associated with increased complications, whereas cardiac disease and age were independent predictors of mortality. Rates of 90-day readmission for TSA and RTSA are 4.5% and 6.6%, respectively,<sup>35</sup> with PE/DVT, pneumonia, infection, and dislocation being the most common reasons.<sup>36</sup> There is inconsistency in the literature on the definition of minor complications. Our study

demonstrated a 9.5% rate of 90-day minor complications versus 17.5% for the inpatient cohort, although these differences are not statistically significant. Similarly, 90-day ED/UC visits (4.8% outpatient versus 5.0% inpatient) and 90-day hospital readmissions (zero outpatient versus 2.5% inpatient) were also similar. No readmissions or ED visits were noted for pain, nausea, or medical problems related to our outpatient protocol and no major complications in the outpatient cohort. Forty percent of outpatients reported pain when queried by phone on postoperative day 1, but no medication changes were needed. Although our facility has 23-hour observation capabilities, no patients required overnight stay and no patients required transfer to an inpatient facility. Our average PACU time of 5 hours 21 minutes reinforces the importance of an early start time.

The outpatient cohort's 100% same-day discharge rate without readmission

for pain or nausea demonstrates the efficacy of the multimodal pain control regimen, which included a local soft-tissue injection with a liposomal bupivacaine/Marcaine cocktail and no regional interscalene block. A recent randomized controlled trial of TSA patients comparing liposomal bupivacaine injection to interscalene brachial plexus blockade demonstrated equivalent postoperative narcotic consumption, superior pain control at 24 hours, less risk of rebound pain, but less predictable pain relief within the first 8 hours.<sup>37</sup> This may place patients at a higher risk for failed same-day discharge but was not encountered in our series of patients or that of Brolin et al. Additionally, prevention of overnight rebound pain by eliminating regional blocks may have contributed to our zero rate of pain-related ED visits or readmissions.

A critical aspect of any outpatient arthroplasty protocol is patient selection. An ideal patient is one with a few medical comorbidities, including no

cardiopulmonary disease, history of DVT/PE, or severe obstructive sleep apnea, ASA of  $\leq 3$ , BMI of  $< 30$ , age  $< 65$  years, opioid naive, no walker or wheelchair dependence, good social support/caregiver at home, lives within 1 hour, and is enthusiastic and motivated for the outpatient process. Overall, ASA score and aCCI can be used but are imperfect predictors of successful early discharge after total joint arthroplasty.<sup>38</sup> Risk stratification tools have recently been developed, including the Outpatient Arthroplasty Risk Assessment score,<sup>38</sup> but have not been validated for use in outpatient shoulder arthroplasty. Given the low rate of intraoperative and postoperative complications for the outpatient cohort in our study, our selection criteria appears adequate, but application of these criteria to a larger cohort in future studies is recommended.

Cost savings for common orthopaedic procedures in an outpatient setting ranges from 17.5% to 57.6% compared with inpatient surgery with a net savings of \$4,000 to \$8,500 for THA and TKA performed outpatient.<sup>39</sup> To our knowledge, cost savings associated with outpatient shoulder arthroplasty has not been thoroughly studied, but comparable savings to THA and TKA can be reasonably inferred. The potential costs savings associated with eliminating a hospital night and associated resources must be balanced with potential financial implications of increased readmissions, ED visits, and revision surgeries. Any increase above current inpatient standards would make an outpatient arthroplasty program cost prohibitive because of readmission penalties and additional losses incurred in a bundled payment model.

Generally, ASCs are the prime target for potential cost savings, and currently, more than 200 ASCs in the United States perform outpatient total joint arthroplasty, up from 25 centers 3

years ago (Modernhealthcare.com 2017). Most outpatient arthroplasty programs have been performed at hospital-based surgical centers; however, several recent studies have demonstrated successful implementation in freestanding ASCs for TKA, THA, and TSA<sup>5,25,26,32</sup> in addition to our current study. Expansion of outpatient arthroplasty programs is currently limited by Medicare reimbursement for outpatient arthroplasty procedures because Medicare does not reimburse for THA, TKA, or TSA performed at an ASC. Patients with Medicare status were excluded from our study because of these reimbursement restrictions. In the future, outpatient shoulder arthroplasty may expand to an older cohort in the event of an expansion of Medicare coverage.

Weaknesses of the current study include the inherent limitations of a retrospective study and relatively low patient numbers. The inpatient cohort was an imperfect control because the ASA classes were different between the groups, and this difference was statistically significant. The inpatient cohort also trended toward higher aCCI scores, rate of diabetes, cerebrovascular accidents/cardiac/pulmonary disease, and current smoking status but was otherwise similar. The patient selection process itself may preferentially select a more resilient cohort, making comparison of the two groups even more difficult. This may help explain the lower 2-week postoperative pain scores for the outpatient cohort. Our follow-up is limited to 90 days, although it is believed most complications would be captured within this window<sup>21,40</sup> and complications specific to the outpatient pathway (ie, pain, nausea, medication side effects) are most relevant in the first few days after surgery. Finally, we did not query patient satisfaction or include a cost analysis.

## Conclusions

This study further strengthens the position that shoulder arthroplasty can be performed safely and predictably as an outpatient in an ASC in properly selected patients. Utilization of a multimodal pain and nausea regimen without regional nerve block proved to allow for acceptable pain levels and ability for same day discharges with no readmissions for rebound pain.

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