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Investigating distress levels in patients with metastatic spine disease undergoing surgical intervention

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OBJECTIVE Cancer patients often experience high levels of distress, which are particularly pronounced in the perioperative period. However, there is a dearth of research on distress rates in patients with metastatic spine disease (MSD). This study aims to assess pre- and postoperative distress levels in patients with MSD undergoing surgical intervention, as well as the association between distress and sociodemographic factors.

METHODS The authors retrospectively queried electronic medical records from a single institution for demographic and clinical data on patients with MSD who underwent surgical intervention between 2015 and 2023. Data included pre- (within 30 days of surgery) and postoperative (within 30 and 90 days of surgery) National Comprehensive Cancer Network's distress thermometer (NCCN-DT) scores. The proportion of patients with clinically significant distress (DT score ≥ 4) at each time point was examined, as well as changes between baseline distress and distress 30 days postoperatively. The association between clinically significant distress and sex, age, race/ethnicity, and marital status was assessed. A p value < 0.05 was considered significant.

RESULTS The study identified 265 patients with complete NCCN-DT questionnaires. Nearly half (47.5%) of the patients were female, with 66.0% identifying as Caucasian/White. The mean (± standard deviation) age at surgery was 61.4 ± 12.1 years. Preoperatively, the mean distress score was 3.6 ± 3.1 (range 0–10), with 89 (46.4%) of 192 patients reporting moderate to severe distress (DT ≥ 4). The mean distress score at 30 days postoperatively was 3.2 ± 3.0 (range 0–10), with 43.8% of patients reporting moderate to severe distress. At 90 days postoperatively, the mean distress score was 2.3 ± 2.5 (range 0–9) with 26.6% of patients reporting moderate to severe levels. Non-White patients had significantly higher preoperative distress than their White counterparts (p = 0.03).

CONCLUSIONS Distress is a common experience among patients with MSD undergoing surgical intervention. Preoperatively, nearly half of these patients report moderate to severe distress, with distress levels remaining elevated through the 1st month after surgery. These findings highlight the critical need for timely psychosocial interventions to address distress at key stages of the surgical process. Race-based differences in distress rates emphasize the importance of developing targeted support strategies for more vulnerable groups.

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KEYWORDS distress; metastatic spine disease; MSD; spine tumor; disparities

Distress, characterized by an unpleasant emotional, psychological, and social experience, profoundly impacts oncology patients by affecting their physical symptoms and overall treatment experience. Distress is particularly prevalent among patients with cancer, with levels reaching as high as 52% as measured by the National Comprehensive Cancer Network (NCCN) distress thermometer (DT).[1–4] Additionally, sociodemographic factors such as age, income, marital status, and gender contribute to varying distress levels, with younger, low-income, single, and female patients often experiencing greater levels of distress.[1,5–7] Although there has been increasing awareness and study of distress in patients with cancer, distress in patients with metastatic spine disease

ABBREVIATIONS DT = distress thermometer; MSD = metastatic spine disease; NCCN = National Comprehensive Cancer Network.

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(MSD) remains unstudied. This represents a significant knowledge gap, given the prevalence of MSD; it is estimated that approximately one-third of individuals with primary cancer will develop spinal metastasis at some point in their lives.[8–10]

MSD is frequently accompanied by an extensive symptom burden, including severe pain, bowel and bladder dysfunction, weakness, sensory changes, and at worst, paralysis.[11–13] In the face of severe pain or neurological dysfunction, surgery can provide significant benefit, including pain relief, reduced opioid use, improved mobility, and enhanced quality of life.[14–16] However, there is limited literature on the psychosocial impact of surgical intervention in patients with MSD, with no study to date evaluating perioperative distress. A prior systematic review demonstrated high overall rates of perioperative distress in patients with cancer, underscoring surgical intervention as a critical time point for psychosocial support among patients with cancer.[17] This review also revealed variations in postoperative distress levels by cancer type, underscoring the complexity of psychosocial distress and the need for disease-specific investigations.[17]

Given the prevalence of MSD, its substantial symptom burden, and the frequent need for surgical intervention, assessing perioperative distress is essential for informed decision-making. Identifying perioperative time points when patients with MSD are most vulnerable to distress will guide more effective interventions. Moreover, it is important to determine whether sociodemographic disparities observed in other cancer populations also apply to patients with MSD. Therefore, this study aims to establish pre- and postoperative distress levels in patients with MSD and explore the influence of sociodemographic factors on distress.

Methods

We conducted a retrospective analysis of adult patients diagnosed with spinal metastases. This study was deemed exempt by the Duke University Health System IRB.

Patient Sample

Patients were identified via our institution's Center for Brain and Spine Metastases. We reviewed all patients with a diagnosis of MSD who underwent surgical intervention for their spinal metastases between January 2015 and October 2023. Data were accessed and collected in December 2023. Patients younger than 18 years and those who did not have DT data available were excluded.

Patient Variables

Patient demographic and clinical data were extracted from the electronic medical record. Demographic variables included patient age at surgery, age at first diagnosis of spinal metastasis, sex, race/ethnicity, and marital status. Clinical variables included date of surgery, admission date, discharge date, procedure, and procedure date.

DT Data

The DT is a screening tool that asks patients to score their level of distress on a scale from 0 to 10, with higher scores indicating greater distress.[18] DT scores and date of completion of the DT were extracted for all eligible patients. DT scores completed within 30 days before surgery and 90 days after surgery were included. When multiple DT scores were recorded on the same day (e.g., from different clinics), the average score for that day was used. The preoperative DT score closest to the surgery date was designated as the baseline score. Postoperative distress scores were recorded for 30 and 90 days after surgery, with 30-day scores including those completed within 3 weeks ± 1 week of surgery, and 90-day scores including those completed within 3 months ± 2 weeks. Patients who underwent subsequent surgeries within these timeframes were excluded from the analysis.

Mean distress scores across the cohort were calculated at each time point, as well as the proportion of patients reporting clinically significant distress, defined as a DT score ≥ 4 according to NCCN guidelines.[19] The relationship between clinically significant distress and sex, age, race/ethnicity, and marital status was evaluated at each time point.

Statistical Analysis

Patient characteristics were summarized with numbers and percentages for categorical variables and mean (standard deviation) for continuous variables. Independent group differences were assessed using t-tests or Mann-Whitney U-tests for continuous variables, and chi-square or Fisher's exact tests for categorical variables. Cross-sectional differences in continuous distress scores and the proportion of patients reporting clinically significant distress at independent time points were analyzed using the Kruskal-Wallis test and chi-square test, respectively. For longitudinal analyses, the Wilcoxon signed-rank test and McNemar's test were used to compare the preoperative period to 30 days postoperatively on categorical and continuous variables, respectively. A post hoc sensitivity analysis was conducted to evaluate potential demographic differences between patients who completed the DT at baseline and those who did or did not complete it at 30 days postoperatively.

Among patients reporting distress (DT score > 0), the association between clinically significant distress (defined as a DT score ≥ 4) at each time point and demographic factors (sex, age, race/ethnicity, and marital status) was assessed using chi-square tests of independence.

All statistical analyses were conducted using RStudio (version 4.2.2, The R Foundation for Statistical Computing) and a significance level of $p < 0.05$ was applied for all tests. No adjustments were made for multiple comparisons.

Results

Patient Demographics

Overall, 397 patients were identified who underwent surgical intervention for their spinal metastases (Table 1). Among these 397 patients, 265 had DT data available at baseline, 30 days, or 90 days postoperatively (Table 2). Of the 265 patients with DT data, 126 (47.5%) were fe-

TABLE 1. Patient demographics (n = 397)

Characteristic	Value
Mean age (SD), yrs	
At surgery	62.0 (12.0)
At spinal metastasis diagnosis	61.0 (11.9)
Sex, n (%)	
Male	212 (53.4)
Female	185 (46.6)
Race, n (%)	
American Indian or Alaskan Native	3 (0.76)
Asian	12 (3.02)
Black or African American	87 (21.9)
Caucasian/White	271 (68.3)
2 or more races	1 (0.25)
Not reported/declined	14 (3.53)
Other	9 (2.27)
Race: categorical, n (%)	
Non-White	126 (31.7)
Caucasian/White	271 (68.3)
Marital status, n (%)	
Single	57 (14.4)
Divorced	44 (11.1)
Legally separated	5 (1.26)
Life partner	2 (0.50)
Married	248 (62.5)
Marital status: categorical, n (%)	
All others	147 (37.0)
Life partner or married	250 (63.0)

TABLE 2. Patient demographics for patients with DT data (n = 265) at baseline, 30 days, or 90 days postoperatively

Variable	Value
Mean age (SD), yrs	
At surgery	61.4 (12.1)
At spinal metastasis diagnosis	60.6 (12.0)
Sex, n (%)	
Male	139 (52.5)
Female	126 (47.5)
Race, n (%)	
American Indian or Alaskan Native	1 (0.38)
Asian	10 (3.77)
Black or African American	63 (23.8)
Caucasian/White	175 (66.0)
2 or more races	1 (0.38)
Not reported/declined	8 (3.02)
Other	7 (2.64)
Race: categorical, n (%)	
Non-White	90 (34.0)
Caucasian/White	175 (66.0)
Marital status, n (%)	
Single	36 (13.6)
Divorced	27 (10.2)
Legally separated	2 (0.75)
Life partner	2 (0.75)
Married	172 (64.9)
Widowed	0 (0.0)
Unknown	0 (0.0)
Marital status: categorical, n (%)	
All others	91 (34.3)
Life partner or married	174 (65.7)

male. The mean (SD) age at the time of surgery was 61.4 (12.1) years, and the mean age at diagnosis of spinal metastasis was 60.6 (12.0) years. One hundred seventy-five patients (66.0%) identified as Caucasian/White and 90 (34.0%) identified as non-White (including Black or African American, Asian, and American Indian or Alaskan Native). Detailed demographic data for all patients who underwent surgical intervention for spinal metastases are provided in Table 1, and demographic data for patients with DT data at baseline, 30 days, or 90 days postoperatively is summarized in Table 2.

Pre- and Postoperative Distress Scores

One hundred ninety-two patients had preoperative baseline distress scores recorded. The mean baseline DT score was 3.6 ± 3.1 (range 0–10), with 89 (46.4%) reporting clinically significant distress (Fig. 1A). One hundred sixty patients had DT scores recorded 30 days postoperatively, with a mean score of 3.2 ± 3.0 (range 0–10). Of these patients, 70 (43.8%) reported clinically significant distress (Fig. 1B). Among the 143 patients who had distress scores recorded 90-days postoperatively, the mean DT score was 2.3 ± 2.5 (range 0–9), with 38 (26.6%) reporting clinically significant distress (Fig. 1C).

Overall, there was a significant difference in median distress scores across the various time periods ($p < 0.001$), as well as in the percentage of patients experiencing clinically significant distress ($p = 0.001$; Table 3). Specifically, 46.4% of patients reported clinically significant distress at baseline, which decreased to 26.6% at 90 days postoperatively. When comparing distress scores between baseline and 30 days postoperatively, no significant reduction in distress was observed among patients who had scores recorded at both time points ($p = 0.208$; Table 4). Sensitivity analysis indicated that there were no significant demographic differences between patients who completed the DT at 30 days postoperatively and those who did not (Table 5).

Sociodemographic Predictors of Distress

Among those reporting distress, non-White patients had significantly higher distress at baseline ($p = 0.03$). Distress rates were similar by patient sex, marital status, and age at baseline (Fig. 2). Although not significant, patients who were White, female, older, and nonmarried/nonpartnered tended to have higher rates of distress at the 30-day postoperative time point.

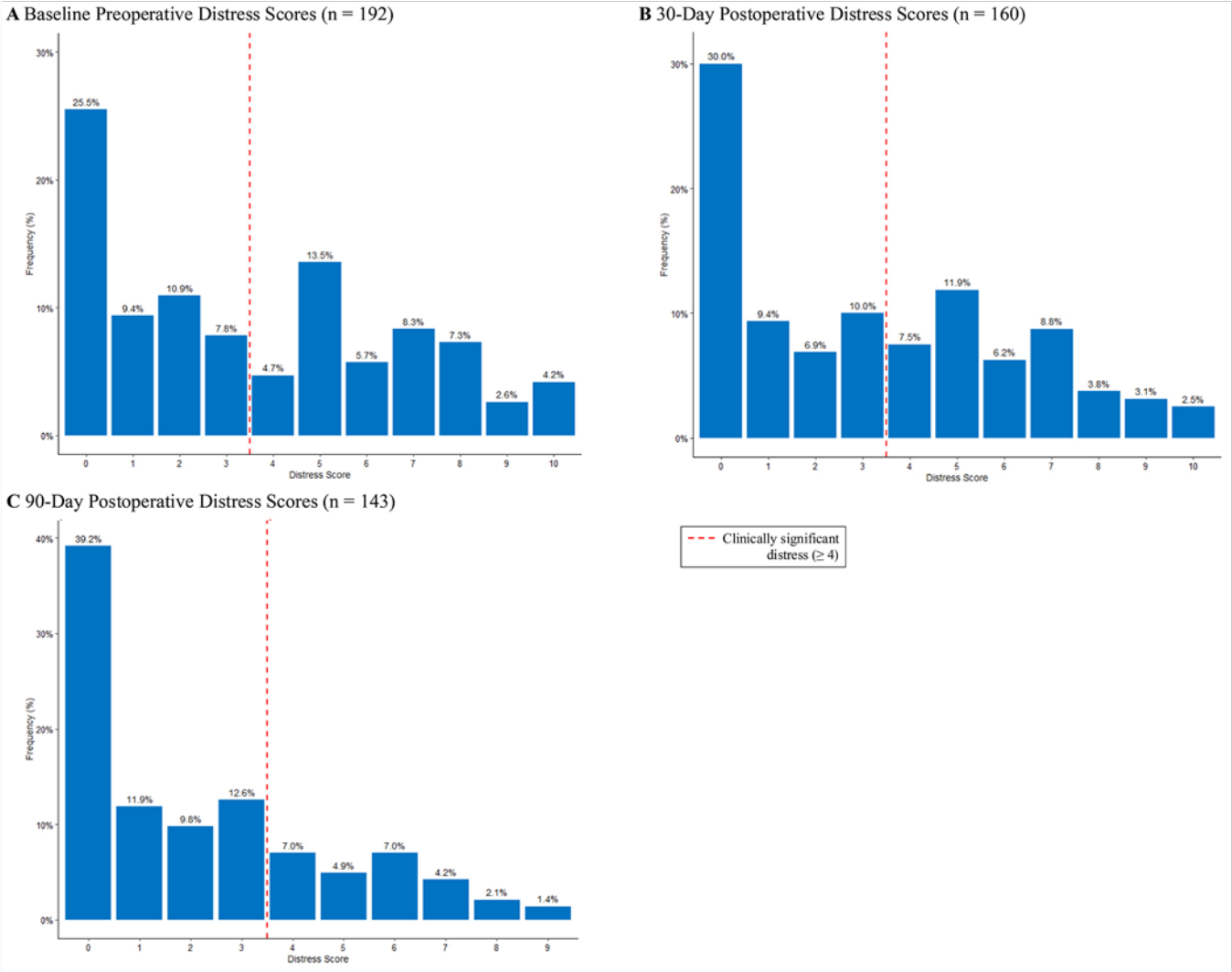

FIG. 1. Bar graphs showing baseline preoperative (**A**; n = 192), 30-day postoperative (**B**; n = 160), and 90-day postoperative distress scores (**C**; n = 143).

Discussion

This study is among the first to provide a comprehensive analysis of perioperative distress among patients with MSD. An important finding is that nearly half of patients with MSD experienced clinically significant distress preoperatively, with elevated distress levels persisting through the 1st month after surgery before beginning to decline. In addition, this study revealed race-based differences in distress levels, with non-White patients reporting

TABLE 3. Distress trends across time points

Distress Variable	Baseline, n = 192	30 Days Postop, n = 160	90 Days Postop, n = 143	p Value
Continuous				
Median (IQR)	3.00 (0.00–6.00)	3.00 (0.00–5.00)	1.00 (0.00–4.00)	<0.001*
Mean (SD)	3.6 (3.1)	3.2 (3.0)	2.3 (2.5)	
Categorical, n (%)				0.001†
<4	103 (53.6)	90 (56.2)	105 (73.4)	
≥4	89 (46.4)	70 (43.8)	38 (26.6)	

* Kruskal-Wallis test.
† Chi-square test.

TABLE 4. Distress trends baseline to 30 days postoperatively

Distress Variable	Baseline, n = 107	30 Days Postop, n = 107	p Value
Continuous			
Median (IQR)	3.00 (0.00–5.00)	2.00 (0.00–5.00)	0.208*
Mean (SD)	3.16 (2.87)	2.75 (2.83)	
Categorical, n (%)			0.606†
<4	64 (59.8)	68 (63.6)	
≥4	43 (40.2)	39 (36.4)	

* Wilcoxon signed-rank test.
† McNemar's test.

higher preoperative distress compared with their White counterparts. These findings highlight critical periods of heightened distress and identify sociodemographic groups at greater risk, emphasizing the need for targeted interventions and enhanced psychosocial support for vulnerable populations.

Few studies to date have investigated perioperative distress in patients with cancer, and none (to the authors' knowledge) have specifically focused on patients with spinal metastases. The existing literature reveals considerable variability in preoperative distress rates across different cancer types. For example, patients with bone and soft tissue tumors have a median preoperative distress score of 2.3, with 31.9% experiencing clinically significant distress.[20] In contrast, patients with endometrial cancer report a median preoperative distress score of 3, with 47.8% experiencing clinically significant distress.[21] Patients with brain cancer, however, exhibit much higher levels of distress, with a mean preoperative score of 6.4 and 59% reporting severe distress (DT > 6).[22] The heightened preop-

TABLE 5. Sensitivity analysis of patients without DT data at 30 days postoperatively

Variable	Patients w/ Baseline But Not 30-Day Postop Data, n = 85	Patients Followed From Baseline To 30 Days Postop, n = 107	p Value
Mean age at surgery (SD), yrs	62.6 (11.6)	60.0 (13.0)	0.169
Sex, n (%)			0.313
Female	35 (41.2)	53 (49.5)	
Male	50 (58.8)	54 (50.5)	
Race, n (%)			0.352
American Indian or Alaskan Native	1 (1.18)	0 (0.00)	
Asian	2 (2.35)	2 (1.87)	
Black or African American	18 (21.2)	21 (19.6)	
Caucasian/White	55 (64.7)	80 (74.8)	
Not reported/declined	5 (5.88)	2 (1.87)	
Other	4 (4.71)	2 (1.87)	
Race: categorical, n (%)			0.175
Non-White	30 (35.3)	27 (25.2)	
Caucasian/White	55 (64.7)	80 (74.8)	
Marital status, n (%)			0.820
Single	9 (10.6)	9 (8.41)	
Divorced	9 (10.6)	10 (9.35)	
Legally separated	0 (0.00)	2 (1.87)	
Life partner	0 (0.00)	1 (0.93)	
Married	57 (67.1)	75 (70.1)	
Unknown	1 (1.18)	0 (0.00)	
Widowed	9 (10.6)	10 (9.35)	
Marital status: categorical, n (%)			0.664
All others	28 (32.9)	31 (29.0)	
Life partner or married	57 (67.1)	76 (71.0)	

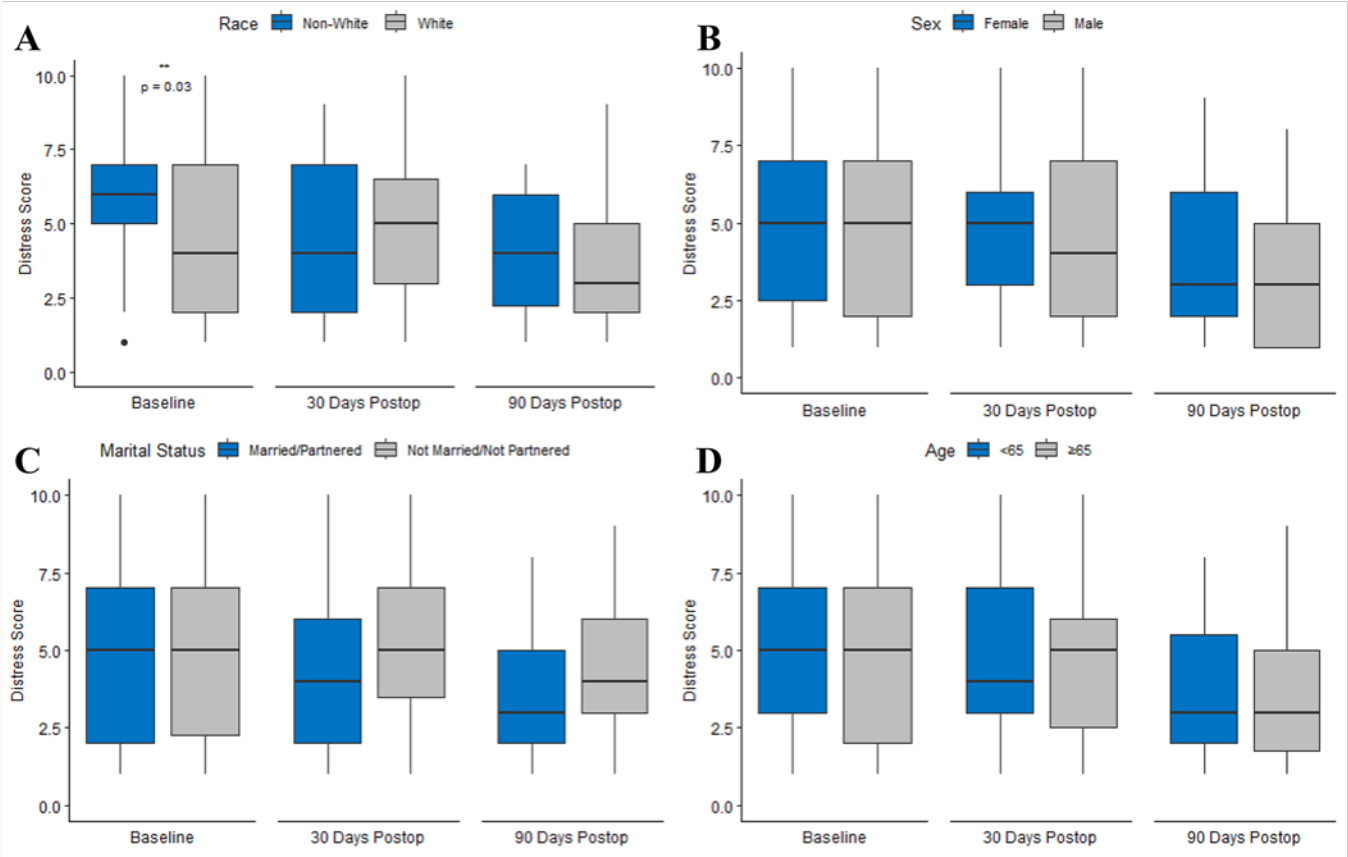

FIG. 2. Box-and-whisker plots showing sociodemographic trends among patients reporting distress according to race (**A**), sex (**B**), marital status (**C**), and age (**D**). **p < 0.05.

erative distress among patients with brain cancer may be attributed to severe symptoms such as headaches, nausea, and seizures, as well as anxiety related to the complexities and risks of brain surgery. The findings of the present study align with the distress levels observed in patients with endometrial cancer but are lower than those reported for patients with brain cancer. This variability underscores the need to tailor distress assessments and support strategies to the specific context of each cancer type.

Moreover, we found that nearly half of patients with MSD continue to experience clinically significant distress 30 days after surgery. This contrasts with the findings of Renovanz et al., who reported a notable decrease in distress among patients with brain cancer within the first 10 days after surgery, with fewer than 40% reporting severe distress compared with nearly 60% preoperatively.[22] The discrepancy between these distress trends highlights the importance of considering cancer type when evaluating psychosocial needs and developing appropriate screening timelines. While distress may be most acute preoperatively for patients with brain cancer, those with MSD face ongoing challenges related to painful recovery and awaiting biopsy results, resulting in persistent distress beyond the initial postoperative period. Therefore, targeted perioperative support for patients with MSD should extend through the 1st month following surgery.

We observed racial disparities in distress among patients with MSD, with non-White patients experiencing higher levels of preoperative distress. This finding is consistent with the broader literature demonstrating that racial and ethnic minorities often face greater distress compared with White patients across various cancer types.[23–25] Disparities in access to and utilization of supportive services further exacerbate these issues, as non-White patients report higher unmet needs and less access to supplemental services such as palliative care and hospice.[26–28] These disparities not only impact patient outcomes and survival rates but also highlight a critical need for targeted interventions.[29,30] The present study thus contributes to the growing body of evidence underscoring the necessity for tailored support strategies to address the unique needs of vulnerable populations, reinforcing the importance of equitable access to comprehensive care and support services.

Our study did not find a significant difference in distress levels based on marital status, which contrasts with prior research suggesting that marriage or a committed relationship often serves as a buffer against distress across various health conditions, including cancer.[7,31,32] Previous studies have demonstrated that married patients tend to have better outcomes, reduced mortality, improved cancer surveillance, and a higher likelihood of seeking definitive care.[33–35] For patients with MSD, who face a considerable burden of disease and may require extensive assistance with activities of daily living, social support becomes even

more crucial.[36,37] It is possible that patients with MSD receive social support in different forms, or that the sample size in our study was insufficient to detect a meaningful difference. Regardless, these findings underscore the ongoing importance of social support in managing distress, particularly for those who are single or live alone, and suggest that future research with larger samples is needed to better understand this relationship.

Limitations of the Study

While this study provides valuable insights into perioperative distress among patients with MSD, it is not without limitations. The DT only offers a partial view of distress; to gain a more comprehensive understanding, future research should incorporate complementary tools such as the NCCN Problem List to identify specific sources of distress. Additionally, the relatively small sample size may have limited our ability to detect significant sociodemographic differences. Furthermore, we did not examine factors such as income, employment, or insurance status, which may influence distress levels. Despite these limitations, the study provides a robust overview of perioperative distress in patients with MSD and underscores the need for ongoing improvements in patient care.

Conclusions

Distress is prevalent among patients with MSD undergoing surgery. Preoperatively, nearly half of these patients report moderate to severe distress, and these distress levels remain elevated through the 1st month postoperatively. This study highlights the critical need for timely psychosocial interventions to address distress at key stages of the surgical process. Race-based differences in distress rates emphasize the importance of developing targeted support strategies for more vulnerable groups. By identifying these high-risk populations, this study underscores the need for tailored, ongoing support to enhance patient care and address disparities in the longitudinal management of MSD.

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Author Contributions

Conception and design: Goodwin, Rowe, Johnson, Erickson. Acquisition of data: Goodwin, Rowe, Goodin. Analysis and interpretation of data: Goodwin, Rowe, Woo, O'Callaghan, Goodin, Crowell, Johnson, Erickson. Drafting the article: Goodwin, Rowe, Woo, O'Callaghan, Barrett, Dalton, Erickson. Critically revising the article: Goodwin, Rowe, Woo, O'Callaghan, Luo, Zachem, Dalton, Crowell, Johnson, Erickson. Reviewed submitted version of manuscript: Goodwin, Rowe, Woo, O'Callaghan, Barrett, Zachem, Dalton, Crowell, Johnson, Erickson. Approved the final version of the manuscript on behalf of all authors: Goodwin. Statistical analysis: Crowell. Administrative/technical/material support: Goodwin, Luo. Study supervision: Goodwin, Erickson.

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