Article

Multidisciplinary Team-Based Perioperative Care in Patients Undergoing Oblique Lumbar Interbody Fusion: Assessing Safety and Surgical Stress in Lumbar Degeneration

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AIM: This study aims to explore the effectiveness of the multidisciplinary team (MDT)-based perioperative care model in the surgical safety and stress response of patients undergoing oblique lumbar interbody fusion (OLIF) for lumbar degeneration (LDD), to provide an evidence-based reference to optimizing the nursing strategy during minimally invasive spine surgery.
METHODS: This retrospective cohort analysis included 100 LDD patients who received OLIF in Beijing Tongren Hospital, Capital Medical University between May 2023 and March 2025. Patients were divided into two groups based on the nursing model: an MDT group (n = 51) and a conventional group (n = 49). The MDT group received an integrated, MDT-based care provided by a team of experienced surgeons, anesthesiologists, rehabilitation experts, nutritionists, and psychologists. The conventional group received traditional single-discipline nursing care. The primary outcome measures included: length of hospital stay (cumulative time from admission to discharge); perioperative safety outcomes (operative time, intraoperative blood loss, and complication rates); physiological and psychological stress responses, including C-reactive protein (CRP), cortisol levels, visual analogy scale (VAS) pain scores, Generalized Anxiety Disorder-7 (GAD-7), and Pittsburgh Sleep Quality Index (PSQI) scores; nursing quality (patient compliance and satisfaction); and short-term imaging indicators such as the 3-month lumbar fusion rate, oswestry disability index (ODI) scores, and the incidence of adjacent segment disease (ASD).
RESULTS: Compared with the conventional group, the MDT group had significantly shorter operation time and less intraoperative blood loss ($p < 0.05$). However, there was no difference in the length of postoperative hospital stays between the two groups ($p > 0.05$). The incidence of postoperative complications was significantly lower in the MDT group than in the conventional group (13.72% *vs*. 28.57%, $p = 0.036$). At postoperative days 1, 3, and 7, the MDT group had substantially lower CRP and Cortisol (Cor) levels than the conventional group ($p < 0.05$). Furthermore, at postoperative days 1 and 3, the MDT care group showed lower VAS and GAD-7 scores ($p < 0.05$). The PSQI was also lower in the MDT group at postoperative days 3 and 7 ($p < 0.05$). In terms of nursing quality, the team nursing compliance (TNC) rate and Nurse-Patient Communication Efficacy (NPCE) were higher in the MDT group than the conventional group ($p < 0.05$), along with a lower non-compliance rate (11.76% *vs*. 30.61%, $p = 0.021$). Finally, patients in the MDT group reported greater nursing satisfaction than the conventional group (88.24% *vs*. 71.43%, $p = 0.036$). The follow-up results showed that there was no difference in ASD between the two groups ($p > 0.05$), but the lumbar fusion rate was higher and ODI was lower in the MDT group ($p < 0.05$).
CONCLUSIONS: In patients with lumbar degenerative diseases undergoing OLIF surgery, perioperative management based on a MDT was associated with improved short-term perioperative outcomes, including reduced surgical stress indicators, decreased postoperative pain and anxiety levels, and lower complication rates. These findings suggested that MDT-based management may be a feasible perioperative management strategy for OLIF, but further prospective studies with longer follow-up were needed.

Keywords: multidisciplinary team nursing; oblique lumbar interbody fusion; surgical safety; stress response; perioperative care

Introduction

The incidence of lumbar degeneration (LDD) is increasing in parallel with global population aging [1]. These diseases often cause persistent low back pain and lower limb neurological dysfunction, which can substantially compromise patients' quality of life [2]. Although traditional open fusion can achieve spinal stability, it is limited by significant surgical trauma, extensive paraspinal soft-tissue disruption, and delayed postoperative recovery [3]. In recent years, oblique lumbar interbody fusion (OLIF) has gradually become a widely adopted surgical option for LDD because it enables access to the disc space through the retroperitoneum, minimizes disruption of the posterior musculoskeletal structures, and offers efficient interbody fusion [4]. Clinical data indicate that patients may ambulate within 3 days following OLIF, and the hospital stay can be reduced by about 40% compared with traditional open surgical procedures [5]. However, OLIF is associated with

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several risks, including infection, vascular injury, postoperative pain, and perioperative stress, especially in patients with comorbidities such as diabetes and cardiovascular diseases, necessitating improved perioperative safety management [6].

Current research evidence supports ongoing advances in the OLIF approach and suggests favorable short-term outcomes. However, perioperative management remains dependent mainly on single-discipline nursing models [7], and multidisciplinary team (MDT)-based perioperative care has not been systematically assessed. This nursing model can address individual patient differences by integrating multidisciplinary resources such as surgery, anesthesia, rehabilitation, nutrition, and psychology [8]. However, its application in OLIF has not been well explored, especially its overall surgical safety outcomes (e.g., complication rates and length of hospitalization stays) and perioperative stress responses (such as inflammatory factor levels, psychological status, pain severity, and other related measures). Furthermore, although MDT-based management has been reported in some clinical studies, much of the current evidence focuses on oncology patients [9,10], thereby limiting the implementation of comprehensive, disease-specific nursing programs into routine clinical practice.

This study aims to systematically evaluate the efficacy of MDT-based perioperative care in patients with LDD undergoing OLIF. By moving beyond a single-discipline nursing method, it develops an integrated and collaborative care system covering preoperative evaluation (such as management of comorbid diseases), intraoperative cooperation (e.g., continuous vital-sign monitoring), and improved postoperative rehabilitation (including goal-oriented analgesia and early functional exercise). Meanwhile, the study assesses both surgical safety indices and perioperative stress-response markers simultaneously, helping to elucidate how MDT-based care may affect both physiological and psychological status. The findings are anticipated to provide an evidence-based perioperative nursing paradigm for OLIF, reduce procedure-related risks and stress by optimizing the MDT framework. Moreover, the study is expected to offer a basis for extending MDT-based approaches to other minimally invasive spine techniques, advancing orthopedic nursing toward precision and multidimensional models.

Methods

Study Design and Participant Selection

This retrospective cohort analysis included LDD patients who underwent OLIF at the Department of Operating Room, Beijing Tongren Hospital, Capital Medical University between May 2023 and March 2025.

Inclusion criteria for patient recruitment were as follows: ① diagnosis of LDD in accordance with the North American Spine Society clinical guidelines [2], including degenerative lumbar spinal stenosis, grade I–II spondylolisthesis, symptomatic lumbar disc herniation, degenerative disc disease with Modic changes, facet joint arthritis, and ligamentum flavum hypertrophy. All cases were confirmed by magnetic resonance imaging (MRI) showing nerve root or thecal sac compression consistent with clinical symptoms; ② age 18–80 years; ③ complete medical records, such as perioperative nursing records, laboratory examinations, imaging data, and follow-up information; ④ eligibility for surgical intervention due to failure of ≥3 months of conservative management (such as physical therapy, pharmacotherapy, or injections); ⑤ radiographic confirmation of 1–2 involved segments between L2/3 and L4/5; and ⑥ scheduled for elective spinal fusion procedure. However, patients were excluded if they had ① spinal tumors, tuberculosis, acute infection, or severe deformity; ② severe cardiopulmonary insufficiency; ③ pre-existing psychiatric diseases (e.g., schizophrenia) or cognitive impairment that could impede cooperation with assessments; and ④ incomplete 3-month follow-up, defined as absence of any primary outcome measures (complication records, 3-month fusion assessment, or oswestry disability index (ODI) score).

Since our hospital formally introduced an MDT-based perioperative care model in June 2024 as part of a hospital-wide practice update, patients were grouped based on the care model they received during their hospitalization. The MDT group (n = 51) included patients admitted after June 2024, after adoption of the MDT care model. The conventional group (n = 49) consisted of patients admitted between May 2023 and May 2024, before MDT adoption, and therefore received traditional single-discipline perioperative care.

Surgical Procedures

All surgical procedures were performed by the same team of experienced spinal surgeons using standardized OLIF protocols. Patients were positioned laterally on the right side with hips and knees flexed at 90°. A 4–5 cm longitudinal incision was made approximately 2 cm below the intersection of the midaxillary line and the iliac crest. After incising the skin and subcutaneous tissues, the external oblique, internal oblique, and transversus abdominis muscles were bluntly dissected to access the retroperitoneal space. Dissection proceeded along the anterior margin of the psoas major muscle to expose the target intervertebral levels (L2–L5). The intervertebral disc tissue was excised, cartilaginous endplates were gently prepared, and an interbody cage filled with an autologous/allogeneic bone composite was implanted. Fascial closure was performed in layers, and a drainage tube was placed.

Conventional Care Group

Preoperative care followed institutional enhanced guidelines and included structured prehabilitation, such as breathing exercises and bedpan training. Postoperative mobilization was protocol-driven with individual adjustment. Patients were allowed to sit with the head of the bed raised to 30° at 6 hours postoperatively if hemodynamically stable (systolic blood pressure (SBP) >100 mmHg and no orthostatic symptoms). Assisted ambulation using a walker was performed 24 postoperatively for 5–10 min/session, three times daily, and adjusted based on pain tolerance (visual analogy scale (VAS) <4) and functional assessment. Furthermore, routine system-based management included daily incision inspection, drainage monitoring with removal when output was <50 mL/24 h and deep venous thrombosis (DVT) prophylaxis using mechanical (intermittent pneumatic compression (IPC) devices intraoperatively, calf pumps postoperatively) and pharmacological (low-molecular-weight heparin 12 h postoperatively). The urinary catheter was removed at 24 h with a voiding trial. Constipation prevention included stool softeners initiated on postoperative day 1 and gradual advancement to a high-fiber diet. Additionally, nutritional intake progressed from clear liquids to a regular diet based on the return of bowel sounds. Postoperatively, a patient-controlled intravenous analgesia pump (sufentanil 2 µg/kg + tropisetron 5 mg in 100 mL saline, background dose 2 mL/h, bolus 0.5 mL, lockout 15 min) was administered for 48 h.

MDT-Based Care Group

A structured MDT team consisting of senior spine surgeons, anesthesiologists, rehabilitation therapists, nutritionists, and psychotherapists delivered coordinated perioperative care. Preoperatively, the surgical and anesthesia experts jointly performed multi-dimensional risk assessments, such as evaluation of OLIF-related vascular injury risk and pain sensitivity. Rehabilitation specialists established individualized early mobilization plans, including semi-Fowler's positioning at 6 hours postoperatively and assisted standing at 24 hours. Nutritional intake was evaluated using the Nutritional Risk Screening-2002 (NRS-2002) tool, and those with hypoproteinemia received oral nutritional supplementation. Psychology assessment was conducted using the Generalized Anxiety Disorder-7 (GAD-7) scale, and individuals with scores of ≥10 received cognitive behavior therapy (CBT) interventions.

Intraoperatively, the nursing team prepared OLIF-specific instruments (such as a lateral retractor and fusion cage) 30 minutes before the procedure. Close cooperation with anesthesia ensured hemodynamic stability, with mean arterial pressure maintained within a target range of 75–95 mmHg. Surgical field bleeding and intraoperative neurophysiological monitoring of the lower limbs were observed to minimize the risk of nerve damage.

Postoperatively, pain management was performed using multimodal analgesia, including local anesthetic infiltration (ropivacaine 0.2% 20 mL), oral anti-inflammatory medication (celecoxib 200 mg twice daily), and transcutaneous electrical nerve stimulation (TENS). The patient-controlled analgesia (PCA) was avoided to reduce opioid-related adverse effects, with analgesic goals defined as a resting VAS ≤3 and an activity ≤5. Patients were assisted to sit with the head of bed elevated 30° at 6 h and to ambulate with a walker (5–10 min/session, 3 times a day) at 24 h postoperatively. The rehabilitation therapists evaluated the gait and muscle strength daily. Nutritional intake included a semi-liquid diet on postoperative day 1, followed by a high-protein diet (such as fish and eggs) on day 3 based on intestinal function recovery, with closed glycemic control and dynamic blood glucose monitoring for those with diabetes. Psychological follow-up was performed on postoperative days 1 and 3, emphasizing relaxation training to reduce pain-related anxiety.

Implementation Considerations of Surgical Interventions

The MDT-based care represents our institution's specialized orthopedic enhanced recovery pathway, implemented as a quality improvement initiative. This protocol involved dedicated resources, including psychological evaluations (a 0.5 FTE psychologist conducting GAD-7 assessments at predetermined timepoints), daily rehabilitation assessments, goal-directed early mobilization pathways, and systematic nutritional screening with individualized interventions. While standardized targets were defined, care delivery was individualized based on patient tolerance and clinical status. Early mobilization goals were adjusted based on hemodynamic stability (target MAP >65 mmHg) and pain severity (VAS >6). Furthermore, nutritional interventions were guided by bowel function recovery rather than fixed timelines. This balance between standardization and individualization enhanced both feasibility and patient safety.

Endpoint Assessment

① Perioperative and safety outcomes included operation time, intraoperative blood loss, need for transfusion, postoperative hospital stays, and the incidence of complications. ② Stress response and patient-reported outcomes were determined by measuring serum C-reactive protein (CRP) and Cortisol (Cor) levels on postoperative days 1, 3, and 7. Additionally, pain, anxiety, and sleep quality were assessed using the VAS [11], GAD-7 [12], and Pittsburgh Sleep Quality Index (PSQI) [13], respectively. ③ Process implementation and quality of care delivery were evaluated through the nursing record sheet and patient log to compare planned *vs.* actual interventions. The team nursing compliance (TNC) rate was then calculated as the proportion of scheduled interventions actually delivered as follows: TNC (%) = (number of interventions performed / number of interventions planned) × 100%. Interventions were documented through standardized checklists with inter-rater reliability >0.90.

Nurse-Patient Communication Efficacy (NPCE) was assessed using the Chinese version of the Nurse-Patient Communication Satisfaction Scale. Patients or family members were interviewed by an independent third-party researcher through a telephone call within 24 hours post-operation. Moreover, patient adherence was examined using the val-

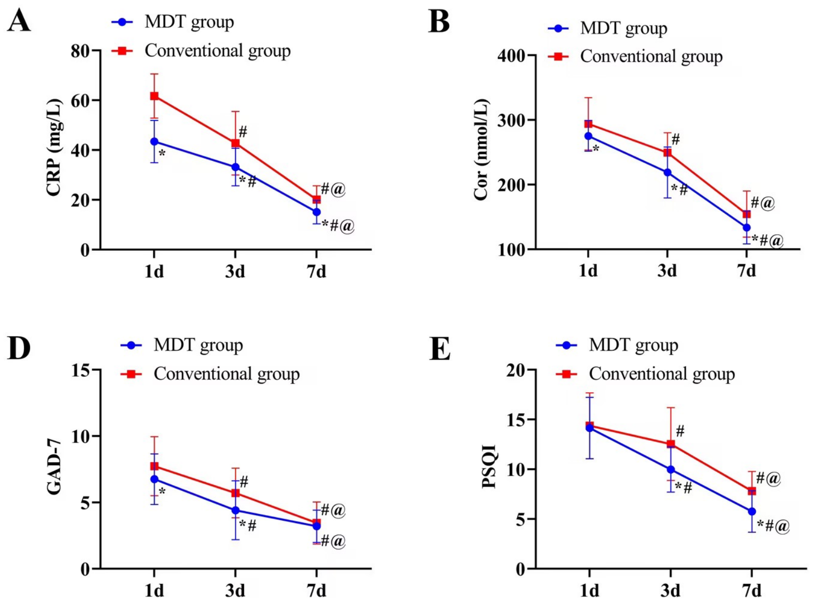

Fig. 1. The changes in postoperative inflammation, stress hormones, pain, anxiety, and sleep quality were evaluated by measuring serum CRP and Cor levels, VAS, GAD-7, and PSQI scales, respectively. (A) Changes and comparison in postoperative CRP levels. (B) Changes and comparison in postoperative Cor levels. (C) Changes in postoperative VAS scores. (D) Changes in postoperative GAD-7 scores. (E) Changes in PSQI after surgery. Note: *p < 0.05 for between-group comparisons at each timepoint; #p < 0.05 for within-group comparisons versus postoperative day 1; @p < 0.05 for within-group comparisons versus postoperative day 3. CRP, C-reactive protein; Cor, Cortisol; VAS, visual analogy scale; GAD-7, Generalized Anxiety Disorder-7; PSQI, Pittsburgh Sleep Quality Index; MDT, multidisciplinary team.

idated Medical Compliance Scale [14]. NPCE included five dimensions: communication skills, information sharing, humanistic support, patient participation and communication outcomes. The total score ranges from 0 to 40, with higher scores indicating better communication effectiveness.

④ Patient satisfaction with perioperative nursing care was assessed upon discharge, using the validated Chinese version of Patient-Professional Interaction Questionnaire (PPIQ-C) [15], which has demonstrated good reliability (Cronbach's α = 0.89) and validity in previous studies. The 10-item scale covers information adequacy, emotional support, and shared decision-making. Responses were categorized as very satisfied (10 points), satisfied (7–9 points), average (4–6 points), dissatisfied (1–3 points), and very dissatisfied (0 points). Overall satisfaction was determined as follows: satisfaction rate = very satisfied rate + satisfied rate.

⑤ Postoperatively, patients were followed for 3 months via scheduled re-examinations. The incidence of adjacent segment disease (ASD) and lumbar fusion status was determined using computed tomography (CT). Fusion was defined as bridging trabecular bone across the graft-host interface with <5° motion on flexion-extension radiographs. ASD was defined as newly identified degeneration at adjacent segments confirmed independently by two radiologists blinded to group allocation. Functional recovery was evaluated using the ODI [16]. All patient-reported outcomes were collected by research assistants blinded to group assignment, and clinical outcomes were assessed by independent evaluators not involved in patient care.

Statistical Analysis

Statistical analysis was conducted using SPSS 31.0 (IBM SPSS statistics). Following confirming normality with the Shapiro-Wilk test, measurement data (continuous variables) were expressed as mean standard ± deviation ($\bar{x} \pm$ s). Between-group comparisons were performed using independent samples t-tests, while within-group differences were assessed using repeated measures analysis of variance. Counting data (categorical variables) were reported as n (%) and compared using the chi-square test or Fisher's exact test, as appropriate. For multiple comparisons involving inflammatory markers (CRP and Cortisol) and patient-reported indicators (VAS, GAD-7, and PSQI), Bonferroni correction was used, with the significance level set to α = 0.0167 (0.05 divided by 3 pairwise comparisons). All other analyses adhered to the standard two-sided significance level of α = 0.05.

Table 1. Comparison of baseline characteristics between the two groups.

Variable		MDT group (n = 51)	Conventional group (n = 49)	Statistics	p-value	95% CI
Age (years)		60.61 ± 13.13	59.27 ± 12.45	$t = 0.524$	0.601	–6.24~3.74
Sex	Male	34 (66.67)	35 (71.43)	$\chi^2 = 0.265$	0.607	0.33~1.86
	Female	17 (33.33)	14 (28.57)			
Course of the disease (years)		5.37 ± 1.67	5.45 ± 1.53	$t = 0.238$	0.812	–0.56~0.71
BMI (kg/m^2)		23.69 ± 1.75	23.31 ± 1.27	$t = 1.252$	0.213	–0.99~0.23
Combined with chronic diseases	Diabetes mellitus	24 (47.06)	22 (44.90)	$\chi^2 = 0.047$	0.828	0.49~2.47
	Hypertension	18 (35.29)	19 (38.78)	$\chi^2 = 0.130$	0.719	0.39~1.87
	Coronary heart disease	8 (15.69)	6 (12.24)	$\chi^2 = 0.246$	0.620	0.44~4.36
Smoking	Yes	22 (43.14)	19 (38.78)	$\chi^2 = 0.197$	0.658	0.52~2.55
	No	29 (56.86)	30 (61.22)			
Drinking	Yes	14 (27.45)	17 (34.69)	$\chi^2 = 0.613$	0.434	0.29~1.66
	No	37 (72.55)	32 (65.31)			
ASA	I	27 (52.94)	30 (61.22)	$\chi^2 = 0.700$	0.403	0.34~1.61
	II	24 (47.06)	19 (38.78)			

Note: MDT, multidisciplinary team; BMI, body mass index; ASA, American Society of Anesthesiologists.

Table 2. Comparison of surgical conditions between the groups.

Variable	MDT group (n = 51)	Conventional group (n = 49)	t	p-value	95% CI
Operation time (min)	181.88 ± 22.80	207.08 ± 40.35	3.865	<0.001	12.26~38.14
Intraoperative blood loss (mL)	84.43 ± 8.68	97.55 ± 25.23	2.963	0.004	4.33~21.91
Postoperative hospital stays (day)	6.10 ± 1.66	6.47 ± 1.52	1.165	0.247	–0.26~1.00

Table 3. Comparison of adverse effects between the groups.

Variable	MDT group (n = 51)	Conventional group (n = 49)	Statistics	p-value	95% CI
Vascular injury [n (%)]	2 (3.92)	5 (10.20)			
Infection [n (%)]	1 (1.96)	3 (6.12)			
Nerve injury [n (%)]	2 (3.92)	3 (6.12)			
Postoperative bleeding [n (%)]	2 (3.92)	3 (6.12)			
Total (%)	13.72	28.57	$\chi^2 = 4.412$	0.036	0.12~0.95

Results

Comparison of Baseline Characteristics Between the Two Groups

Statistical analysis revealed that the MDT and conventional care groups were comparable at baseline, with no significant differences in age, sex, disease duration, comorbidities, and other baseline characteristics ($p > 0.05$, Table 1).

Comparison of Surgical Conditions and Postoperative Complications Between the Groups

In terms of intraoperative outcomes, the MDT group showed significantly shorter operative time ($p < 0.001$, 95% CI = 12.26~38.14) and reduced intraoperative blood loss ($p = 0.004$, 95% CI = 4.33~21.91). Blood transfusion was needed in 3 patients in the MDT group and 10 patients in the conventional group, indicating a considerably lower transfusion rate in the MDT group ($p = 0.031$, 95% CI = 0.07~0.96). However, postoperative length of hospital stays did not differ substantially between the groups ($p > 0.05$). Additionally, the overall incidence of postoperative complications was lower in the MDT group ($p = 0.036$, 95% CI = 0.12~0.95) (Tables 2,3).

Postoperative Changes in Inflammation, Stress Hormones, Pain, Anxiety, and Sleep Quality

Patients receiving MDT-based care demonstrated significantly lower CRP and Cor levels compared with those undergoing routine care on postoperative days 1, 3, and 7 ($p < 0.05$). Regarding psychological stress, VAS and GAD-7 scores were comparable between the two groups by postoperative day 7 ($p > 0.05$); however, these scores were lower in the MDT group on postoperative days 1 and 3 ($p < 0.05$). Furthermore, sleep quality demonstrated a similar pattern in both groups: PSQI score did not differ on day 1, whereas the MDT group showed lower PSQI scores on postoperative days 3 and 7 ($p < 0.05$, Fig. 1).

Comparison of Perioperative Nursing Implementation Quality

Compared with the conventional group, the MDT group showed a higher TNC rate ($p = 0.047$, 95% CI = 1.05~6.86) and better NPCE ($p < 0.001$, 95% CI = 2.50~6.33). Furthermore, noncompliance was less frequent in the MDT group than in the conventional group ($p = 0.021$, 95% CI = 0.11~0.84) (Tables 4,5).

Table 4. Comparison of TNC rate and compliance between the groups.

	TNC rate [n (%)]	Complete compliance	Partial compliance	Noncompliance
MDT group (n = 51)	43 (84.31)	26 (50.98)	19 (37.25)	6 (11.76)
Conventional group (n = 49)	33 (67.35)	16 (32.65)	18 (36.73)	15 (30.61)
χ^2	3.944	3.446	0.003	5.351
p-value	0.047	0.063	0.957	0.021
95% CI	1.05~6.86	0.93~4.80	0.47~2.23	0.11~0.84

Note: TNC, team nursing compliance.

Table 5. Comparison of NPCE between the groups.

Group	NPCE
MDT group (n = 51)	31.35 ± 4.80
Conventional group (n = 49)	26.94 ± 4.82
t	4.584
p-value	<0.001
95% CI	2.50~6.33

Note: NPCE, Nurse-Patient Communication Efficacy.

Comparison of Nursing Satisfaction Between the Groups

The satisfaction survey conducted upon patient discharge revealed the MDT group showed a substantially higher satisfaction rate (88.24%) than the conventional care group (71.43%; $p = 0.036$, 95% CI = 1.05~8.69, Table 6).

Comparison of Prognosis and Postoperative Rehabilitation Between the Groups

At the 3-month postoperative CT reexamination, the incidence of ASD differed substantially between the two groups ($p > 0.05$). Conversely, the MDT group achieved a considerably higher lumbar fusion rate (86.27%) than the conventional group ($p < 0.05$). Consistently, the ODI scores were lower in the MDT group, indicating better functional recovery ($p < 0.05$, Table 7).

Discussion

This study compared MDT-based perioperative care with routine nursing in patients undergoing OLIF. Overall, the MDT group outperformed the conventional group with respect to surgical safety, modulation of perioperative stress responses, nursing care quality, and early functional recovery. Although the 3-month postoperative incidence of ASD was comparable between the two groups, MDT-based care offered broader benefits across physiological and psychological, supporting it as an optimized perioperative management technique for LDD patients undergoing OLIF.

Firstly, the greater reductions in intraoperative blood loss and postoperative complication rates in the MDT group indicate that multidisciplinary coordination can improve perioperative risk control. Joint preoperative vascular risk assessment by surgeons and anesthesiologists, such as evaluation for lumbar arterial variations, may help reduce unexpected vascular injuries during the procedure [17]. Furthermore, an early mobilization plan led by rehabilitation experts, such as semi-recumbent positioning at 6 hours and ambulation at 24 hours after surgery, may minimize the risk of deep vein thrombosis by limiting prolonged immobilization [18]. Notably, the lower incidence of postoperative complications observed in the MDT group may also be related to early nutritional support initiated after recovery of intestinal function, which provides adequate nutritional support for tissue repair after recovery of intestinal function [19]. Compared with a previous study that primarily focused on single nursing measures such as analgesic approaches or nutritional interventions [20], MDT care supports a continuous "preoperative-intraoperative-postoperative" pathway of risk prevention by integrating multidisciplinary resources. This observation is consistent with Liu Y *et al.* [21], who reported reduced complication rates in spinal surgery patients managed using an enhanced recovery after surgery (ERAS)-MDT model.

Additionally, the lower pain and anxiety scores in the MDT group on postoperative days 1 and 3 likely reflect the synergistic effect of multimodal analgesia (local infiltration anesthesia + oral analgesics) and psychological intervention (CBT). Although GAD-7 scores were comparable between the two groups by postoperative day 7, the findings suggest that MDT-based care offers early benefits in stress modulation, possibly through rapid rehabilitation measures, including early functional exercise that helps reduce stressors and restore patient satisfaction. The between-group differences in physiological stress indexes further support this interpretation. These findings are also consistent with the theory proposed by Celik MO *et al.* [22] that multimodal analgesia may reduce systemic inflammatory responses.

Subsequently, we quantified the "process-level advantage" of MDT-based care across three domains: team implementation, patient participation (compliance), and communication quality. Unlike previous studies that primarily focused on outcomes such as complications or functional scores [23,24], this approach helps elucidate how MDT-based care "works"—through standardized implementation, active patient cooperation, and effective communication that together form a closed-loop management framework. Meanwhile, these observations also provide a basis for optimizing MDT-based workflows in clinical practice, for example, by strengthening team training in steps with low TNC and increasing education and follow-up for the low-PNP groups. With respect to prognosis and rehabilitation qual-

Table 6. Comparison of nursing care satisfaction between the groups.

Group	Very satisfied [n (%)]	Satisfied [n (%)]	General [n (%)]	Dissatisfied [n (%)]	Very dissatisfied [n (%)]	Overall satisfaction rate (%)
MDT group (n = 51)	21 (41.18)	24 (47.06)	4 (7.84)	2 (3.92)	0 (0.00)	88.24
Conventional group (n = 49)	13 (26.53)	22 (44.90)	7 (14.29)	5 (10.20)	2 (4.08)	71.43
χ^2						4.41
p-value						0.036
95% CI						1.05~8.69

Table 7. Comparison of postoperative rehabilitation between the groups.

Group	ASD [n (%)]	Lumbar fusion rate [n (%)]	ODI (%)
MDT group (n = 51)	4 (7.84)	44 (86.27)	15.78 ± 5.15
Conventional group (n = 49)	6 (12.24)	34 (69.39)	18.71 ± 4.33
Statistics	Fisher's exact test	$\chi^2 = 4.153$	$t = 3.076$
p-value	0.521	0.042	0.003
95% CI	0.19~2.22	1.05~7.02	1.04~4.82

Note: ASD, adjacent segment disease; ODI, oswestry disability index.

ity, MDT-based care may indirectly promote lumbar fusion by optimizing the biomechanical environment and overall metabolic state. Progressive mobilization and weight-bearing rehabilitation (gradually increasing activity levels 4 weeks after surgery) can provide appropriate mechanical stimulation to the fused segments. At the same time, nutritional support, including amino acid supplementation, may maintain integrity of the cartilage matrix, collectively establishing more favorable conditions for lumbar fusion.

Based on these findings, we propose two clinically significant recommendations: ① Construction of standardized MDT-based perioperative care pathway: Perioperative guidelines for OLIF should incorporate a comprehensive MDT workflow, including preoperative multi-dimensional risk assessment (vascular risk, pain vulnerability, and nutritional status), intraoperative goal-oriented monitoring (hemodynamic optimization and neuro-electrophysiological monitoring), and postoperative stepwise rehabilitation. ② Enhancement of interdisciplinary team capabilities: Regular multidisciplinary case discussions involving surgeons, anesthesiologists, and rehabilitation therapists should be institutionalized, and simulation-based intraoperative team training should be expanded, with emphasis on managing vascular emergencies and responding to abnormal neurophysiological monitoring signals.

Because MDT-based perioperative care was introduced in our institution in June 2024, patient grouping was necessarily based on admission time periods. We acknowledge that this time-based grouping may introduce potential temporal confounding, including increasing surgical team experience over time and potential updates in perioperative resources. To address these concerns, we: (1) ensured consistent surgical teams throughout the study period; (2) documented that no major equipment upgrades occurred between 2023 and 2025; and (3) recorded comparable patient referral sources and baseline disease severity across the two periods based on baseline characteristic analyses. However, due to the inherent bias of a retrospective design, the selection bias cannot be completely eliminated even when baseline variables appear balanced.

In addition, this single-center cohort of 100 cases may limit the generalizability of the results, and multi-center studies are required for validation. The 3-month follow-up also limits assessment of long-term outcomes, including adjacent segment degeneration and fusion durability; studies with follow-up of at least two years are required to assess whether the observed advantages persist. Moreover, patient-reported satisfaction and psychological measures may be affected by social desirability and expectation bias. Finally, due to the sample-size limitations, this pilot study did not include prespecified subgroup analyses by age, diabetes status, or body mass index (BMI). Future studies incorporate stratified analyses to identify patient subgroups most likely to benefit from MDT-based treatment and to offer more comprehensive validation of these results.

Conclusions

MDT-based perioperative care is associated with improved surgical safety and more effective regulation of stress response in patients undergoing OLIF. The findings provide preliminary evidence for optimizing perioperative management approaches, although further validation through well-designed prospective studies is warranted. Furthermore, the MDT framework demonstrates potential for replication in other minimally invasive spine surgeries.

Availability of Data and Materials

The data analyzed are available from the corresponding author upon reasonable request.

Author Contributions

SL, conceptualization, data curation, formal analysis, investigation, methodology, software, visualization, writing—original draft. YL, project administration, validation, resources, supervision, conceptualization, methodology, writing—review & editing. Both authors have been involved in revising the manuscript critically for important intellectual content. Both authors gave final approval of the version to be published. Both authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

Ethics Approval and Consent to Participate

All patients provided informed consent to participate in this study, and the study was conducted in adherence to the principles outlined in Declaration of Helsinki. This study was approved by the ethics committee of Beijing Tongren Hospital, Capital Medical University (Approval No. 2025BL02-036-06).

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Conflict of Interest

The authors declare no conflict of interest.

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