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Perioperative Predictive Nursing Care for a Patient with Marfan Syndrome Undergoing Scoliosis Correction Surgery: A Case Report

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Abstract: This paper summarizes the perioperative predictive nursing experience of a patient with Marfan syndrome complicated with severe scoliosis who underwent posterior corrective internal fixation. Patients with Marfan syndrome often involve multiple systems such as the skeleton, cardiovascular system, and respiratory system due to connective tissue abnormalities, and undergoing scoliosis correction surgery carries a high risk of bleeding and a high incidence of complications. Nursing points included: conducting multidisciplinary joint assessment and cardiopulmonary function optimization before surgery, establishing an individualized blood management plan; strengthening intraoperative bleeding monitoring and temperature management to prevent nerve injury; focusing on preventing complications such as intraspinal hematoma, infection, and correction decompensation after surgery, and implementing stepwise rehabilitation training. After careful treatment and nursing care, the patient was discharged from the hospital on the 12th day after surgery, and the correction effect was satisfactory during the 6-month follow-up without serious complications.

Keywords: Marfan syndrome; Scoliosis; Orthopedic surgery; Predictive nursing; Perioperative nursing

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1. Introduction

Marfan syndrome (MFS) is an autosomal dominant connective tissue disorder caused by mutations in the FBN1 gene, with a global prevalence of approximately 1/5,000 to 1/3,000 [1]. It is characterized by multisystem involvement, primarily affecting the skeletal, cardiovascular, and ocular systems. Scoliosis is one of the most common skeletal manifestations of MFS, occurring in 40–60% of affected individuals, with characteristics including early onset, rapid progression, large Cobb angles, and high surgical complexity [2]. A subset of patients ultimately requires posterior spinal corrective surgery.

Patients with MFS who undergo scoliosis correction face multisystem challenges. Cardiovascular risks are prominent, as patients frequently present with aortic root dilation and an elevated risk of aortic dissection, significantly increasing the risk of perioperative cardiovascular events [3]. With regard to bleeding, MFS-associated aortic dilation, endothelial injury, and hemostatic abnormalities may predispose patients to substantial intraoperative hemorrhage, substantially exceeding that seen in non-MFS scoliosis patients [4]. Postoperative complications, including dural tear, surgical site infection, and correction decompensation are also markedly more prevalent [5].

Predictive nursing (anticipated nursing care) refers to a nursing model in which nursing staff apply professional knowledge and clinical experience to prospectively assess potential risks and preemptively implement targeted interventions [6]. However, reports specifically addressing perioperative predictive nursing for patients with MFS undergoing scoliosis correction remain limited.

In November 2025, our department admitted a patient with MFS and severe scoliosis (Cobb angle 85°) who underwent posterior corrective internal fixation. Through systematic perioperative predictive nursing, the patient achieved a favorable recovery without serious complications. The nursing experience is reported herein.

2. Clinical data

2.1. General information

2.1.1. Chief complaint

A 14-year-old female patient was admitted on November 10, 2025, with a 2-year history of progressive scoliosis.

2.1.2. Symptoms and signs

The patient was 162 cm tall and weighed 42 kg (body mass index 16.0 kg/m^2), with a slender physique and arachnodactyly. Physical examination revealed an “S”-shaped spinal curvature with unequal shoulder heights and left scapular prominence. Preoperative Cobb angle measured 85°. The patient reported exertional fatigue and occasional palpitations.

2.1.3. Past medical history

MFS was genetically confirmed in 2024. Echocardiography showed mild aortic root dilation (32 mm) and mild mitral regurgitation. Ophthalmologic examination revealed bilateral high myopia (−8.0 D) with normally positioned lenses. Pulmonary function testing indicated restrictive ventilatory dysfunction (forced vital capacity 62% of predicted value).

2.1.4. Admission diagnosis

Marfan syndrome; scoliosis (Cobb angle 85°).

2.2. Treatment and outcome

Following multidisciplinary consultation involving orthopedics, cardiology, pulmonology, and anesthesiology, the patient was deemed able to tolerate surgery despite high risks of hemorrhage, cardiovascular adverse events, and difficult airway management. After thorough preoperative preparation, posterior scoliosis correction with pedicle screw-rod internal fixation and bone grafting fusion was performed under general anesthesia on November 18, 2025.

The procedure lasted 5.5 hours. Intraoperative blood loss was approximately 800 mL; the patient received 4 units of packed red blood cells and 400 mL of fresh frozen plasma, and 450 mL of autologous blood was recovered via cell salvage. Intraoperative vital signs remained stable without cardiovascular events. The patient was transferred to the ICU on postoperative day 1 and returned to the orthopedic ward on day 2. The drainage tube was removed on postoperative day 3; the patient ambulated with a spinal orthosis on day 5 and was discharged on day 12. At discharge, the Cobb angle had been corrected to 20° (correction rate 76.5%). At 6-month follow-up, internal fixation position was satisfactory, with no correction loss, infection, or pseudarthrosis.

3. Nursing care

3.1. Preoperative multidisciplinary assessment and risk stratification

MFS involves multiple organ systems, and patients undergoing scoliosis correction have a substantially higher prevalence of preoperative echocardiographic abnormalities and ventilatory dysfunction compared with non-MFS patients [7]. In this case, the patient presented with aortic root dilation (32 mm) and restrictive ventilatory dysfunction (FVC 62% predicted), indicating elevated perioperative risks for cardiovascular and respiratory complications.

In response, the responsible nurse participated in multidisciplinary team (MDT) consultations involving orthopedics, cardiology, pulmonology, and anesthesiology to collaboratively formulate an individualized perioperative management plan. Preoperative assessment focused on:

(1) Cardiac structure and function (aortic root diameter, valvular function, cardiac functional classification);
(2) Respiratory function (vital capacity, blood gas analysis, airway assessment);
(3) Coagulation status and hemorrhage risk;
(4) Nutritional status and skin integrity

A risk stratification checklist was established, with high-risk items (aortic root dilation, ventilatory dysfunction, bleeding tendency) flagged with red-level alerts and incorporated as priorities in each nursing handover.

3.2. Preoperative cardiopulmonary optimization

Preoperative respiratory training is a key measure to reduce postoperative pulmonary complications [8]. Given the patient's restrictive ventilatory dysfunction, respiratory exercises were initiated 7 days before surgery and included:

(1) Diaphragmatic breathing training, 3 sessions per day, 15 minutes per session;
(2) Pursed-lip breathing with an inspiration-to-expiration ratio of 1:2–1:3;
(3) Effective cough training—deep inhalation followed by 2–3 seconds of breath-holding before forceful expectoration;
(4) Balloon-blowing training, 3 sets per day, 5–10 repetitions per set, to strengthen respiratory muscles.

For cardiovascular management, metoprolol (12.5 mg twice daily) was administered as prescribed to maintain the heart rate at 60–70 beats/min and reduce aortic wall shear stress [9]. Blood pressure was monitored with a target systolic pressure below 120 mmHg. Current evidence supports routine preoperative cardiopulmonary evaluation in MFS patients and recommends invasive monitoring when indicated [10].

3.3. Individualized preoperative blood management

Owing to connective tissue fragility and tortuous periosteal and paravertebral vasculature in MFS, intraoperative blood loss is significantly greater than in non-MFS scoliosis surgery. Chen et al. reported that MFS patients undergoing scoliosis correction had higher intraoperative blood loss and allogeneic transfusion rates compared with non-MFS patients [11]. Predictive blood management is therefore essential.

Preoperative measures included:

(1) Baseline complete blood count and coagulation profile assessment;

(2) Oral iron supplementation (polysaccharide-iron complex 150 mg once daily) for 3 days preoperatively to enhance hemoglobin reserves;

(3) Blood product reservation (6 units of packed red blood cells, 600 mL of fresh frozen plasma, 10 units of cryoprecipitate, and 1 therapeutic dose of platelets) with an expedited blood supply pathway established;

(4) Coordination with the operating room for intraoperative autologous blood salvage device preparation.

3.4. Intraoperative management of high bleeding risk

Prior to surgery, operating room nurses jointly reviewed the blood management protocol with the anesthesiologist and surgeon. Key intraoperative measures included:

(1) Establishing at least two peripheral intravenous accesses in addition to central venous catheterization to ensure adequate transfusion capacity;

(2) Assisting with controlled hypotension (mean arterial pressure 65–70 mmHg) to reduce intraoperative bleeding;

(3) Monitoring complete blood count and coagulation parameters every 30 minutes with preemptive blood product requests based on trends;

(4) Activating autologous blood salvage to reduce allogeneic blood exposure. In this case, the 800 mL intraoperative blood loss was managed through cell salvage (450 mL recovered) combined with allogeneic transfusion (4 units of packed red blood cells), maintaining circulatory stability throughout.

3.5. Intraoperative predictive temperature management

Massive transfusion, large-volume fluid infusion, and prolonged surgical exposure can cause perioperative hypothermia, which in turn impairs coagulation and increases hemorrhage risk [12]. Preventive warming measures included:

(1) Presetting the operating room temperature to 23–25 ℃;

(2) Applying a forced-air warming blanket to non-surgical body areas;

(3) Warming all intravenous fluids and blood products to 37 ℃ via a fluid warming device before infusion;

(4) Preheating surgical irrigation fluids to 37 ℃ in a warming cabinet. Nasopharyngeal temperature was monitored continuously throughout the procedure with a target range of 36.0–37.0 ℃.

3.6. Postoperative early identification and warning of intraspinal hematoma

Intraspinal hematoma following spinal corrective surgery is a serious complication that can cause irreversible neurological injury if not promptly managed. The incidence of dural tear in MFS patients has been reported to reach 8%, and delayed hematoma formation remains a concern even after drain removal [13]. Predictive monitoring included:

(1) Hourly assessment of bilateral lower extremity sensation, motor function, and anal sphincter tone during the first 24 postoperative hours;
(2) Implementation of a standardized neurological function assessment record reviewed at each handover;
(3) Predefined alert criteria, immediate physician notification and emergent CT or MRI if worsening lower limb numbness, motor power decline of ≥ 1 grade, or new radicular pain was detected;
(4) Drain care with continuous monitoring of drainage fluid characteristics and volume, triggering an alert if sanguineous drainage exceeded 300 mL within 24 hours.

In this case, drainage volume was 250 mL (sanguineous) on postoperative day 1, 120 mL (serosanguineous) on day 2, and 30 mL on day 3 prior to removal. Neurological function assessments remained normal throughout.

3.7. Surgical site infection prevention

FBN1 gene mutation in MFS results in fibrillin-1 deficiency, reducing connective tissue elasticity. The thin dermis and poor suture retention associated with this condition place MFS patients at substantially higher risk for impaired wound healing and surgical site infection than non-MFS patients, necessitating enhanced perioperative wound management [14,15]. Predictive infection prevention measures included:

(1) Strict intraoperative aseptic technique with efforts to minimize operative time;
(2) Prophylactic intravenous cefuroxime 1.5 g administered 30 minutes before skin incision and continued for 48 hours postoperatively;
(3) Wound assessment at each nursing shift for signs of erythema, swelling, warmth, tenderness, and discharge, with documentation of wound healing grade;
(4) Blood glucose monitoring with postoperative glucose maintained below 10 mmol/L to mitigate stress-related hyperglycemia.

3.8. Prevention of correction decompensation

The incidence of postoperative correction decompensation following scoliosis surgery has been reported at 8% for coronal decompensation and 21% for sagittal decompensation [13]. Ligamentous laxity and suboptimal bone quality in MFS patients further elevate this risk. Predictive measures included:

(1) Strict spinal orthosis wear for 3–6 months postoperatively, with the orthosis temporarily removed in the supine position;
(2) Instruction in correct log-roll turning technique to maintain spinal alignment and avoid rotational forces;
(3) Preambulation assessment of balance and muscle strength by a rehabilitation therapist, with gradual progression from sitting to standing and walking;
(4) Patient and family education on orthosis application and skin care prior to discharge.

3.9. Postoperative stepwise rehabilitation training

Early mobilization following spinal surgery reduces the risk of deep vein thrombosis, pulmonary infection, and muscle atrophy, provided that spinal stability is ensured. According to a standardized early mobilization protocol based on ERAS principles for spinal deformity surgery [16]:

(1) Postoperative day 1

Ankle pump exercises and isometric quadriceps contractions in bed, 3 sets per day, 20 repetitions per set;

(2) Postoperative day 2

Assisted log-roll turning to the lateral position, with position changes every 2 hours;

(3) Postoperative day 3

Nurse-assisted sitting up with spinal orthosis following drain removal;

(4) Postoperative day 5

Standing and progressive ambulation with spinal orthosis.

In this case, the patient successfully ambulated on postoperative day 5 and was able to walk 50 meters at the time of discharge on day 12.

4. Discussion

Patients with MFS undergoing scoliosis correction face perioperative challenges across multiple organ systems. The complexity of this nursing case lies in the need to simultaneously manage cardiovascular risk, intraoperative hemorrhage, airway difficulties, and a spectrum of postoperative complications, all within the context of an underlying connective tissue disorder that affects healing and stability.

Predictive nursing enabled the structured anticipation of complications before they occurred. Through preoperative MDT collaboration, known risks were quantified and assigned to specific monitoring and intervention protocols. The cardiopulmonary optimization program addressed the restrictive ventilatory dysfunction and cardiovascular instability characteristic of MFS, consistent with recommendations in the literature [7,10]. The individualized blood management plan, which combined preoperative iron supplementation, meticulous intraoperative hemorrhage control, and cell salvage, effectively limited allogeneic transfusion requirements, an approach supported by evidence of elevated transfusion burden in MFS scoliosis surgery [11].

Postoperative vigilance for intraspinal hematoma using hourly neurological assessments during the first 24 hours reflected the recognized risk of dural complications in this population [13]. Infection prevention was tailored to the MFS phenotype given the well-documented impairment in wound healing attributable to fibrillin-1 deficiency [14,15]. The stepwise rehabilitation protocol, grounded in an ERAS-based expert consensus for spinal deformity surgery, facilitated early safe ambulation on postoperative day 5 [16].

Together, these interventions contributed to a favorable clinical outcome: Cobb angle correction from 85° to 20° (correction rate 76.5%), discharge on postoperative day 12, and no serious complications at 6-month follow-up.

5. Conclusion

When a patient with MFS is planned for scoliosis correction surgery, nursing staff should prioritize cardiovascular and respiratory risk assessment, individualized hemorrhage management, and postoperative neurological monitoring. Implementing structured predictive nursing across the perioperative continuum, from multidisciplinary preoperative evaluation through stepwise postoperative rehabilitation can reduce perioperative complication rates and improve surgical outcomes. The present case demonstrates the feasibility and potential value of this approach; however, as a single case report, further multicenter studies and larger case series are warranted to validate the nursing protocol.

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Disclosure statement

The authors declare no conflict of interest.

References

[1] Connolly H, Niaz T, Bowen J, 2023, What Is Marfan Syndrome? JAMA, 329: 1618.

[2] Soto M, Fuentevilla-Alvarez G, Koretzky S, et al., 2023, Analysis of GPR126 Polymorphisms and Their Relationship with Scoliosis in Marfan Syndrome and Marfan-Like Syndrome in Mexican Patients. Biomol Biomed, 23: 976–983.

[3] Milewicz D, Braverman A, De Backer J, et al., 2021, Marfan Syndrome. Nat Rev Dis Primers, 7: 64.

[4] Kornhuber K, Seidel H, Pujol C, et al., 2019, Hemostatic Abnormalities in Adult Patients with Marfan Syndrome. Cardiovasc Diagn Ther, 9: S209–S220.

[5] Kurucan E, Bernstein D, Ying M, et al., 2019, Trends in Spinal Deformity Surgery in Marfan Syndrome. Spine J, 19: 1934–1940.

[6] Bottega M, Palese A, 2020, Anticipated Nursing Care: Findings from a Qualitative Study. BMC Nurs, 19: 93.

[7] Oliveira J, Visconti R, Azevedo G, et al., 2025, Long-Term Pulmonary Function After Combined Anteroposterior Spinal Fusion for Scoliosis in Neurofibromatosis Type 1 and Marfan Syndrome at a Mean Follow-Up of 13 Years. Rev Bras Ortop, 60: 001–008.

[8] Lee J, Won Y, Choi W, et al., 2013, Successful Surgery for Scoliosis Supported by Pulmonary Rehabilitation in a Duchenne Muscular Dystrophy Patient with Forced Vital Capacity Below 10%. Ann Rehabil Med, 37: 875.

[9] Koo H, Lawrence K, Musini V, 2017, Beta-Blockers for Preventing Aortic Dissection in Marfan Syndrome. Cochrane Database Syst Rev, 11(11): CD011103.

[10] Pūkas A, Stankutė D, Gudaitytė J, 2025, Anesthetic Management of a Patient with Marfan Syndrome Undergoing Elective Ventral Hernia Repair. Healthcare, 14: 34.

[11] Chen W, Liu Z, Yu X, et al., 2017, Perioperative Blood Management for Patients with Marfan Syndrome Undergoing Scoliosis Correction Surgery. Basic and Clinical Medicine, 37(8): 1157–1160.

[12] Li Y, Zhang H, Chen X, et al., 2021, Research Progress on Perioperative Hypothermia Risk Prediction Models. Nursing Research, 35(17): 3107–3110.

[13] Jones K, Erkula G, Sponseller P, et al., 2002, Spine Deformity Correction in Marfan Syndrome. Spine, 27: 2003–2012.

[14] Recker M, Kronenwetter N, Reynolds R, et al., 2022, Impaired Wound Healing Following Cranial Vault Reconstruction in a Patient with an Atypical Phenotype of Marfan Syndrome: A Case Report. Surg Neurol Int, 13: 328.

[15] Redlinger R, Rushing G, Moskowitz A, et al., 2010, Minimally Invasive Repair of Pectus Excavatum in Patients

with Marfan Syndrome and Marfanoid Features. J Pediatr Surg, 45: 193–199.
[16] Bai Y, Zhai X, Chen Z, et al., 2020, Expert Consensus on Perioperative Management Strategy of Enhanced Recovery After Surgery for Degenerative Scoliosis. Journal of Second Military Medical University, 41(3): 233–242.

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