Roy Adaptation Model in Perioperating Nursing Management of Patients with HNP L5-S1 Post Microdisectomy Operation: A Case Study

Anna Kurnia[1](✉), Ratna Sitorus[2], I. Made Kariasa[2], and Enny Mulyatsih[3]

[1] Nursing Department, Faculty of Nursing and Health Sciences, Muhammadiyah University of Semarang, Semarang, Indonesia
`annakurnia@unimus.ac.id`
[2] Faculty of Nursing, Universitas Indonesia, Depok, Indonesia
[3] National Brain Center Hospital Dr. Mahar Mardjono, Jakarta, Indonesia

Abstract. Background: Hernia Nucleus Pulposus (HNP) is among the most prevalent spinal conditions. HNP is a condition in which the nucleus pulposus protrudes through the torn annulus fibrosus and presses against the spinal canal. The majority of HNP is located in the lumbar vertebrae, while only a small percentage is found in the cervical region. Lumbar HNP is most prevalent in the L4-L5 and L5-S1 regions. Patients with HNP may experience disturbances in their physiological, psychological, and social functions, as well as their independence in participating in daily activities, as a result of the impact and nursing issues they experience. Based on this, a comprehensive evaluation is required to assess these functional changes.

Aim: The purpose of this case study is to apply Roy's adaptation theory to analyze the nursing process in HNP L5-S1 patients following microdiscectomy surgery.

Methods: This study describes in detail the nursing process for HNP L5-S1 patients following microdiscectomy surgery.

Results: The nursing process based on Roy's adaptation theory that has been implemented with HNP patients demonstrates that the patient can control the disease and its complications through the development of adaptive behavior.

Conclusion: Active participation of the patient in the nursing process facilitates physical and psychological adaptation.

Keywords: HNP · ERAS · Surgical Wound Infection

1 Introduction

Hernia Nucleus Pulposus (HNP) is among the most prevalent spinal conditions. HNP is a condition in which the nucleus pulposus protrudes through the torn annulus fibrosus and presses against the spinal canal. HNP occurs when the nucleus pulposus extrudes from the intervertebral disc space and presses on a nearby nerve root [1]. The lumbar spine is the most common location for HNP, while only a small percentage is found in

the cervical region. Lumbar HNP occurs most frequently in the L4-L5 or L5-S1 region [2].

Hernia Nucleus Pulposus (HNP) is influenced by two factors: intrinsic and extrinsic factors. Lifestyle, age, degenerative processes, weight, medical history, and gender are intrinsic factors, while lifting, carrying, bending, sitting for long periods, pulling, pushing, bending, dropping, and twisting are extrinsic factors. Repetitive motion, trauma, injury, long-term mechanical combinations, compression, chemical irritation of the nerve roots, environmental factors, and repetitive movements on one side all contribute to carpal tunnel syndrome [2].

The prevalence of HNP in Indonesia has not been specified, but the prevalence of joint disease significantly increases after age 45. In Indonesia, the prevalence of low back pain is estimated to range between 7.6% and 37%. Low back pain is the most common clinical symptom observed in patients with HNP, whereas HNP in the cervix causes neck, shoulder, and arm pain. Additionally, HNP can cause neurological symptoms that correspond to the dermatome of the affected nerve. Other symptoms of HNP include pain, motor weakness, diminished reflex function, and sensory deficits [1]. HNP can inhibit multiple nerve roots, resulting in paralysis of the lower extremities, urinary disorders, and bowel disorders. The impact of this disease's symptoms can diminish quality of life and increase morbidity.

Patients with HNP may experience disturbances in their physiological, psychological, and social functions, as well as their independence in participating in daily activities, as a result of the impact and nursing issues they experience. On this basis, a comprehensive evaluation is required to assess these functional changes [3]. The purpose of this case study is to apply Roy's adaptation theory to analyze the nursing process in HNP L5-S1 patients following microdiscectomy surgery.

2   Methods

This study describes in detail the nursing process for HNP L5-S1 patients following microdiscectomy surgery.

3   Case Study

A 50-year-old female patient (Mrs.D) was admitted to the PON Hospital with a medical diagnosis of L5-S1 lumbar HNP. The patient arrived at the Polyclinic on March 7, 2022 to undergo a scheduled microdisectomy. The patient's medical history reveals complaints of pain in the calves, heaviness in the calves to the soles of the feet, numbness in the soles of the feet, and pain in the knees when used for prostration. The patient has experienced this for the past six months. Patients post-MRI at RSPON prior to scheduled surgery. The patient was evaluated upon entering the ward at 13:55 on March 7, 2022. During the evaluation, the patient complained of a headache, had a blood pressure of 140/70 mmHg, a heart rate of 87 beats per minute, and a respiratory rate of 14 beats per minute. The patient has a previous history of vertigo and gallstone surgery in 2019. Both of the patient's parents have a history of hypertension and stroke, and the patient has had hypertension since the patient was 32 years old, 14 years ago. The patient

has taken diclofenac sodium, gabapentin, B12, atorvastatin, clobazam, carbamazepine, adalat aros, and miniaspi in the past (has stopped 1 month ago). Based on Roy's adaptation theory, the first step in the nursing process is to identify maladaptive behavior from physiological modes, self-concepts, role concepts, and interdependence. Identifying the stimulant for each of these maladaptive behaviors is the second step. The subsequent step is to determine the proper nursing plan [3]. Based on Roy's adaptation model theory, the patient's evaluation revealed the following findings:

1. **Oxygenation and Circulation**

    Patient claims: The patient said he had no complaints with breathing, the patient did not cough or shortness of breath.

    Postoperative Physical Examination: the patient is not on a respirator. The results of physical examination of the lungs showed symmetrical lungs, no deformity, no injury, resonant percussion, vesicular sounds, no additional breath sounds. SI-SII heart sounds, no murmurs or gallops, strong pulse with frequency, CRT <2 seconds, no extremity edema. The patient has a history of hypertension since 14 years ago

2. **Nutrition**

    Patient claims: The patient complains of nausea.

    Physical Examination: PONV score 2 (nausea and vomiting)

    Focal stimulus: nausea and vomiting, contextual stimulus: delayed gastric emptying due to sedation, residual stimulus: none

3. **Elimination**

    Patient claims: none

    Physical examination: Bowel sounds 5×/min. Currently, postoperative H+2, the patient has not defecated

    Focal stimulus: pain on movement, contextual stimulus: decreased mobility affects peristaltic movement, residual stimulus: none

4. **Activity and Rest**

    Patient claims: The patient said he was afraid to move because he felt pain. Physical examination: Motor function 5555/5555, normal muscle tone. The patient may grimace when moving or moving the extremity. There is an expression of discomfort

    Focal stimulus: limited activity, contextual stimulus: root pain consistent with VL5-S1 disc herniation, residual stimulus: old age, overweight

5. **Protection**

    The patient claims: the patient says the back pain radiates to the legs, the legs feel tingling, the patient also feels dizzy like spinning, the patient says he has a history of vertigo

    Physical examination: The patient appears to close his eyes to reduce pain, VAS 6.

    Physical Examination: VAS 6, moderate risk of falling, low risk of pressure sores, 7 cm long incision wound in lumbar area, surgical wound covered with sterile gauze, sufratul and hypafik. The wound condition is clean, no redness, no pus, no seepage. No drain installed and no specimen for examination.

    Focal stimulus: postoperative incision wound, contextual stimulus: postoperative wound healing process (inflammatory phase), residual stimulus: none

6. **Neurology**

   Patient claims: the patient said he would be more careful with his diet and exercise.

   Physical examination: Motor function showed muscle strength 5555/5555, normal muscle tone, hypoesthesia in lateral femur, fibula and right plantar. Sensory function showed hypoesthesia-paraesthesia according to right VL5-S1, radicular pain according to right VL5-S1

   Focal stimulus: pain and tingling that radiates from the waist down to the legs and feet, contextual stimulus: herniation of the vertebral disc at L5-S1, residual stimulus: old age, overweight

7. **Liquids and Electrolytes**

   Patient claims: The patient complained of a lot of urine, after the catheter was removed the patient felt that he could not hold his urine.

   Physical examination: the patient has a foley catheter inserted. Input: 1500 cc (oral) + 450 cc (infusion) = 2550 cc, Output: 2300 cc (urine) + 700 cc (IWL) = 3000 cc, Fluid Balance: −450 cc/24 hours, Diuresis: 1.7 cc/hour

   Focal stimulus: uncontrolled urine elimination, contextual stimulus: emphasis on lumbar level, residual stimulus: none

8. **Endocrine Function**

   Patient claims: The patient said he had no history of DM. Physical examination: there is no enlargement of the thyroid gland. Investigations: the results of postoperative laboratory examinations showed a GDS value of 156 mg/dl

Self-Concept Mode: the patient asks about how to do activities at home, how to take a bath, how to control weight and how to treat surgical wounds.

Role Concept Mode: the patient feels that his activities are still very limited, the patient hopes to recover soon so that he can carry out daily activities as usual.

Interdependence Mode: The patient's greatest support is the patient's husband and children. The patient's husband always waits and takes care of the patient while in the hospital. The patient's husband seemed attentive by always helping the patient's needs and activities while in the hospital.

The established nursing diagnoses are (1) chronic pain due to nerve compression and (2) risk of peripheral neurovascular dysfunction as evidenced by post-microdisectomy risk factors. (3) impaired physical mobility due to neuromuscular disorders; (4) constipation due to decreased intestinal motility; and (5) mixed urinary incontinence due to decreased bladder muscle tone. (6) risk of surgical wound infection as evidenced by risk factors: ASA ≥ 2, obesity, general anesthesia, hypertension, invasive procedures; (7) lack of knowledge regarding home care due to insufficient exposure to information. Postoperative nursing interventions concentrate on pain management, the prevention of surgical site infections, gradual mobilization, the management of constipation, the monitoring of fluid balance, and the preparation of patients for discharge.

Implementation for nursing diagnoses of acute pain related to physical injury agents include: (1) regulator: monitors pain quality, location and spread of pain, pain scale, duration and frequency of pain, teaches deep breathing relaxation, provides head-up position,

trains left and right oblique mobilization. Right angled, measuring vital signs, collaborative administration of analgesics ketorolac 3×30 mg (IV), PCT 3×1000 mg (orally) and (2) cognators: explaining therapeutic effects and side effects of drugs, recommending patients to do relaxation techniques.

Implementation for nursing diagnoses of risk for peripheral neurovascular dysfunction is evidenced by risk factors: post microdiscectomy include: (1) regulators: monitor muscle tone, motor function and gait, identify changes in sensation, examine differences in sharp and dull sensations, monitor paresthesias, collaboration in drug administration Gabapentin 150 mg 2×1 (PO) and (2) cognator: instructs proper posture and movement during activities.

Implementation for nursing diagnoses of physical mobility disorders related to neuromuscular disorders include: (1) regulator: identifying complaints of pain when moving, assessing movement function limitations, assessing muscle strength, facilitating mobilization activities, collaboration with physiotherapists for mobilization programs and (2) cognator: explaining gradual mobilization goals and procedures.

Implementation for nursing diagnoses constipation related to decreased intestinal motility includes: (1) regulators: identify medications that affect gastrointestinal conditions, monitor bowel movements (e.g., color, consistency, volume), monitor signs and symptoms of constipation, check bowel sounds, perform abdominal massage, giving warm water after eating and when you wake up in the morning, collaborative use of laxatives in the form of lactulose syrup and giving glycerin and (2) cognators: explaining the types of foods that help improve the regularity of intestinal peristalsis, recommend noting the color, frequency, consistency, Stool volume, recommends increasing physical activity, according to tolerance, recommends reducing the intake of foods that increase gas formation, recommending high-fiber foods, recommending increasing fluid intake.

Implementation for nursing diagnoses of mixed urinary incontinence related to decreased bladder muscle tone includes: (1) regulator: monitors urine elimination, frequency, odor, volume and color, identifies factors that cause episodes of incontinence, monitors intake and output, adjusts monitoring time intervals accordingly. With the patient's condition, document and inform the results of monitoring and (2) cognator: teach the patient and family to record urine output, encourage the patient to drink a minimum of 1500 cc per day, reduce the consumption of foods or drinks that can irritate the bladder such as: soft drinks, tea, coffee and chocolate.

Implementation for nursing diagnoses of surgical wound infection risk is evidenced by risk factors: ASA ≥ 2, obesity, general anesthesia, hypertension including regulatory activities, namely washing hands 5 moments, maintaining aseptic technique during wound care, collaborative administration of ceftriaxone 2×1 gr (IV) antibiotics.

Implementation for nursing diagnoses knowledge deficits about home care related to lack of information include: (1) regulators: identify readiness to receive information, identify patient knowledge about treatment, involve families in patient care, help patients prepare for discharge, identify patient and care giver understanding of knowledge and skills needed during home care and (2) cognators: recommend taking medication as indicated, encourage asking if something is not understood, provide education about constipation management at home, provide education about physical activity at home,

involve family to provide support to the patient. Patients during treatment and during control, explaining the benefits and side effects of treatment.

Nursing evaluation for nursing diagnoses of acute pain related to physical injury agents, namely the patient said the pain was improving but still felt tingling in the left leg, the patient was able to use non-pharmacological techniques of deep breathing relaxation to reduce pain, right root pain improved, BP: 164/103 mmHg, HR 86×/min., RR 17×/min., pain improves, left leg tingling. The problem is resolved, the follow-up plan is the motivation for pain control with non-pharmacological techniques.

Nursing evaluation for nursing diagnoses of risk for peripheral neurovascular dysfunction is evidenced by risk factors: post microdiscectomy, namely the patient says the left leg is still tingling, current consciousness is composmentary (GCS E4M6V5), muscle tone is normal, there is hypoesthesia-paraesthesia according to the right L5-S1 dermatome improving. The problem is resolved, the follow-up plan is to make sure the patient controls to the Neuroperipheral Poly and Neurosurgery Poly on time.

Nursing evaluation for nursing diagnoses of physical mobility disorders related to neuromuscular disorders, namely the patient says that he will exercise slowly, increase left lower extremity movement, upper extremity muscle strength: 5555/5555, lower extremity muscle strength: 5555/5555, lower extremity range of motion left increased, the patient's level of mobilization is walking slowly, balance when standing is quite good, BP 130/97 mmHg, HR 87×/min., RR 16×/min., temperature 36 °C. The problem is resolved, the follow-up plan is to follow up the patient's activities at home.

Nursing evaluation for nursing diagnoses of constipation related to decreased intestinal motility, namely the patient has not defecated for 3 days, BP 122/76 mmHg, HR 82×/min., RR 16×/min., temperature 36.7 °C, SpO2 100%, glycerin has been done, but the patient not defecate H + 4 postoperatively. The problem has not been resolved, continue the intervention of monitoring the patient's bowel frequency at home.

Nursing evaluation for nursing diagnosis of mixed urinary incontinence is related to decreased bladder muscle tone, namely the patient complains of a lot of urine, the patient has diapers, no signs of dehydration, no excessive thirst, spontaneous urination, input: 1800 cc (drinking) + 500 cc (RF infusion) + 106 cc (drugs) = 2406 cc, output: 2100 cc (urine) + 885 cc (IWL) = 2985 cc, fluid balance: −579 cc/24 h, diuresis: 0.55 cc/kgBW/h. The problem has not been resolved, the follow-up plan is to monitor the frequency of urination and the amount of urine at home.

The nursing evaluation for nursing diagnoses is the risk of surgical wound infection as evidenced by risk factors: ASA 2, obesity, general anesthesia, hypertension, namely there are no signs and symptoms of infection in the surgical wound.

Nursing evaluations for nursing diagnoses of knowledge deficits about home care are related to lack of information, namely the patient says the information provided is clear, the patient is able to re-explain the education that has been given, questions about preparing to go home and home care decrease. The problem is resolved, the follow-up plan is a contract when the patient is next in control at the Neurosurgery Polyclinic and Neurosurgery Polyclinic.

4   Discussion

The postoperative evaluation revealed a reduction in root pain. A study determined that the greater the pain intensity in patients with lumbar HNP, the greater the physical function impairment [4]. Root pain and surgical wound pain cause the patient to subjectively report fear of movement. This creates nursing difficulties in the form of decreased physical mobility. While gradual mobilization is one of the interventions given to the patient from day one postoperatively until the patient returns home, the patient is taught early on to move the joints in flexion and extension in the feet, ankles, and knees daily after waking up, before eating, at noon, and before bed. This is intended not only to increase muscle strength, but also to prevent the formation of DVT (Deep Vein Thrombosis).

On the first postoperative day, the patient's foley catheter was removed and he began to experience excessive and uncontrollable urination. The patient experienced this condition until the fourth postoperative day before being discharged. Previous research attempted to explain this phenomenon as a neurogenic bladder, which is a disorder of the lower urinary tract caused by nerve damage that impairs the sphincter muscles' function [5]. The sacral micturition center, pontine micturition center, and cerebral cortex are responsible for physiological urination. The sacral micturition centers at S2–S4 are reflex centers where parasympathetic efferent impulses cause bladder contraction and afferent impulses provide feedback on bladder fullness. When the bladder contracts, the pontine micturition center is responsible for coordinating the relaxation of the sphincter. Damage to these nerves will result in urinary incontinence. Lower motor neuron neurogenic bladder disorders are triggered by damage to the micturition center and peripheral nerves, while the sympathetic nervous system in the urinary system remains undamaged. This results in a large bladder capacity with intact internal sphincter innervation and low detrusor tone (detrusor areflexia) [5].

The preoperative evaluation revealed that the patient's BMI was 31.08 kgbb/m^2, which places the patient in the obese BMI category. Based on the mechanism that the lumbar vertebra supports the majority of the body's weight relative to other vertebrae, the greater the body weight, the greater the load that must be supported by the vertebrae. According to the findings of previous studies, obesity is the primary predictor of readmission for patients with surgical wound infections [6]. This indicates that patients with a BMI greater than 30 have a higher risk of readmission due to surgical site infection (obese). The following preoperative data is the patient's ASA category, which is ASA III. This is due to the patient's co-morbidities, which include hypertension. According to the findings of previous studies, the ASA score evaluates an individual's baseline status, including comorbidities; therefore, the ASA score is an accurate predictor of the risk of ILO. Patients with ASA II-V had a significantly higher risk of ILO than those with ASA I [7]. The risk of surgical wound infection becomes a nursing concern based on these data, as patients must be educated to prevent surgical wound infections. One of the preparations for returning home includes education about the recommended diet or nutrition. Patients are instructed to consume high-calorie, high-protein foods to promote wound healing. In addition, patients are advised to eat fruits and vegetables and drink enough fluids to prevent constipation. Patients are discouraged from consuming foods that are too cold, too spicy, and other stomach-irritating foods.

Previous research indicates that if the knowledge gap is not addressed, it can lead to anxiety, which can increase postoperative pain, the use of analgesics, recovery time, and length of hospital stay [8]. On the basis of these conditions, a nursing diagnosis of knowledge deficit must be established. Education provided by nurses regarding bladder management, specifically: (1) Bladder diary by recommending a daily fluid intake of approximately 1,800 ml and a urine output of approximately 1,600 ml. This can be accomplished by (1) drinking 400 ml at each meal and an additional 200 ml at 10 a.m., 2 p.m., and 4 p.m., (2) maintaining an ideal body weight to improve verterbrae function, and (3) limiting the consumption of foods and drinks that can irritate the bladder, such as beverages containing caffeine [5]. In order to prevent surgical wound infections, patients must be instructed to keep the wound clean and dry, and the wound must be treated with aseptic techniques. Recommend foods high in protein.

Comprehensive perioperative nursing care based on Roy's adaptation theory, which incorporates physiological functions, self-concept, roles, and interdependencies, can increase the postoperative therapeutic effect, accelerate postoperative recovery, and shorten the patient's hospital stay [9]. According to the findings of previous studies, nursing care that includes health education based on Roy's adaptation theory and telephone follow-up can be crucial interventions that contribute to the patient's coping and adaptation process in complaint management, compliance, and knowledge improvement. This demonstrates that Roy's adaptation theory can be applied to the coping and adaptation processes of the patient [10]. This model can be utilized by nurses to enhance patient adaptation. The nursing process based on Roy's adaptation theory that has been applied to HNP patients demonstrates that patients can achieve disease control goals and complications through the development of adaptive behavior. Active participation of the patient in the nursing process facilitates physical and psychological adaptation.

5   Conclusions

The nursing process based on Roy's adaptation theory that has been carried out on patients with HNP shows that through the formation of adaptive behavior, the patient can achieve the goal of controlling the disease and its complications. The patient's active participation during the nursing process helps achieve physical and psychological adaptation.

Authors' Contributions.   All authors contributed equally in preparing all parts of the research.

References

1. A. Azharuddin, T. Aryandono, R. Magetsari, and I. Dwiprahasto, "Predictors of the conservative management outcomes in patients with lumbar herniated nucleus pulposus: A prospective study in Indonesia," *Asian J. Surg.*, vol. 45, no. 1, pp. 277–283, 2022, https://doi.org/10.1016/j.asjsur.2021.05.015.

2. A. Fithri, "Gambaran Faktor Risiko Pada Pasien Herniasi Nukleus Pulposus Di Rumah Sakit Umum Pusat Haji Adam Malik," *Univ. Sumatera Utara*, vol. 1, no. 1, pp. 1–68, 2017.

3. N. Alimohammadi, B. Maleki, M. Shahriari, and A. Chitsaz, "Effect of a care plan based on Roy adaptation model biological dimension on stroke patientsâ physiologic adaptation level," *Iran. J. Nurs. Midwifery Res.*, vol. 20, no. 2, pp. 275–281, 2015.

4. N. Nasikhatussoraya, R. Octaviani, and H. Julianti, "Hubungan Intensitas Nyeri Dan Disabilitas Aktivitas Sehari-Hari Dengan Kualitas Hidup Pasien Dengan Kanker Kolorektal," *J. Kedokt. Diponegoro*, vol. 5, no. 4, pp. 1364–1377, 2016.

5. S. Wulandari, "Neurogenic bladder: DynaMed," *J. Kedokt.*, vol. 1, no. 1, pp. 1–18, 2016, [Online]. Available: http://web.b.ebscohost.com.ezproxy.spfldcol.edu/dynamed/detail?vid=2&sid=b68b3f9f-1fbe-42ef-b5e8-b05a8fc3a458%40sessionmgr114&hid=106&bdata=JnNpdGU9ZHluYW1lZC1saXZlJnNjb3BlPXNpdGU%3D#db=dme&AN=900602&anchor=GenRef5029.

6. M. S. Walid, J. S. Robinson, E. R. M. Robinson, B. B. Brannick, M. Ajjan, and J. S. Robiinson, "Comparison of outpatient and inpatient spine surgery patients with regards to obesity, comorbidities and readmission for infection," *J. Clin. Neurosci.*, vol. 17, no. 12, pp. 1497–1498, 2010, https://doi.org/10.1016/j.jocn.2010.03.037.

7. A. Asrawal, R. Summary, D. Hasan, and D. Daniel, "Faktor Risiko Terjadinya Infeksi Daerah Operasi pada Pasien Bedah Orthopedi di RSUP Fatmawati Periode Juli-Oktober 2018," *J. Sains Farm. Klin.*, vol. 6, no. 2, p. 104, 2019, https://doi.org/10.25077/jsfk.6.2.104-112.2019.

8. J. S. Lee, Y. M. Park, K. Y. Ha, S. W. Cho, G. H. Bak, and K. W. Kim, "Preoperative anxiety about spinal surgery under general anesthesia," *Eur. Spine J.*, vol. 25, no. 3, pp. 698–707, 2016, https://doi.org/10.1007/s00586-015-3788-2.

9. W. Quan, "A study on postoperative nursing of minimally invasive surgery for lumbar disc herniation," *Food Sci. Technol.*, vol. 42, pp. 1–9, 2022, https://doi.org/10.1590/fst.56321.

10. S. Turan Kavradim and Z. Canli Özer, "The effect of education and telephone follow-up intervention based on the Roy Adaptation Model after myocardial infarction: randomised controlled trial," *Scand. J. Caring Sci.*, vol. 34, no. 1, pp. 247–260, 2020, https://doi.org/10.1111/scs.12793.