(Re)defining nurse and patient roles in routine postoperative neurosurgical care: empowering autonomy and strengthening collaborative roles

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Chapter 1
General introduction and thesis outline

Clinical importance and history of urine monitoring
Urine monitoring has been a fundamental aspect of medical practice since ancient times, serving as a critical indicator of a patient's fluid balance, renal function, and overall hemodynamic status (1). This practice extends beyond mere measurement of urine output; it encompasses the detailed analysis of urine composition, such as specific gravity, electrolyte levels, and the presence of proteins or glucose, which provide essential insights into a patient's metabolic and renal function (2).

A widely utilized technique for urine monitoring is the use of urinary catheters, with evidence of their application dating back to approximately 3000 BCE. Early urinary catheters were constructed from primitive materials such as hollow reeds and metal tubes (3). Over centuries, advancements in urinary catheter technology included the 18th-century introduction of silver catheters and the 19th-century adoption of rubber catheters, each representing a significant step forward in urological care (4). The most transformative development in urinary catheterization emerged in the 1930s when Frederic Foley invented his groundbreaking catheter design. The Foley catheter's innovative balloon mechanism, which prevents the device from becoming dislodged, quickly established itself as the gold standard in catheterization procedures and continues to maintain this position in modern clinical practice (5). Within the broader field of urinary catheterization, two distinct categories of devices serve different clinical needs. The first category consists of indwelling urinary catheters (IDUCs), commonly known as Foley catheters, which provide continuous, long-term drainage solutions. The second category encompasses intermittent catheters, which are designed for single-use, short-term drainage sessions that patients or healthcare providers repeat as necessary based on individual medical requirements (6).

Prevalence of urinary catheterization
IDUCs are widely used in various healthcare settings, particularly hospitals, with studies indicating that approximately 15%–25% of hospitalized patients receive an IDUC during their stay (7). The use of IDUCs is even more prevalent in surgical care, where over 80% of patients require catheterization, particularly during or after major procedures (8). Obtaining precise and current numbers on the use of intermittent catheterization in hospitals is more challenging, as the data is often less widely reported than that for IDUCs. However, existing literature suggests that intermittent catheterization is employed in approximately 10%–20% of hospitalized patients (6).

Complications of urinary catheterization
Although urinary catheterization is essential in certain clinical scenarios, it carries significant risks. The most common complication is catheter-associated urinary tract infection, which accounts for approximately 9% of all healthcare-acquired infections (9). The daily risk of developing this type of infection ranges from 3% to 7% with an IDUC (10). These infections not only increase patient morbidity but also lead to higher healthcare costs, extended hospital stays, and, in severe cases, mortality (11). Additionally, urinary catheters can cause a range of other complications, including urethral trauma, bladder spasms, and the formation of bladder stones (12). The presence of an IDUC can also hinder early mobilization, increase the risk of deep vein thrombosis, and contribute to patient discomfort and psychosocial distress (13).

Urine monitoring in the postoperative phase
The role of urine monitoring and urinary catheter use plays a critical role in hospital care,

with particular significance in the management of neurosurgical patients. This importance becomes especially evident when managing two specific groups of patients. The first group consists of those undergoing transsphenoidal pituitary surgery, while the second includes patients undergoing spinal fusion procedures, also known as spondylodesis. Each of these patient populations presents distinct requirements for precise urine monitoring, reflecting the unique challenges and complications that can arise during their respective surgical procedures and recovery periods. Transsphenoidal pituitary surgery, which is performed to remove pituitary tumors, carries a significant risk of endocrine disturbances due to manipulation of the pituitary gland, which regulates various hormonal functions.

During the postoperative phase, healthcare providers, particularly nurses, must carefully monitor fluid balance to detect a serious potential complication known as Arginine Vasopressin Deficiency (AVP-D) (14). This condition manifests through the excretion of large volumes of dilute urine, making vigilant monitoring of both urine output and specific gravity crucial components of postoperative care (15). Through such careful observation, medical teams can ensure timely intervention when necessary and support optimal patient recovery. Though not as extensively studied, there are indications that patients undergoing spinal fusion surgery may have a heightened risk of developing postoperative urinary retention due to the possibility of neurological impairment (16). Consequently, urine monitoring is vital to prevent bladder overdistention (17). Furthermore, postoperative urine output monitoring is essential for accurately assessing a patient's fluid balance and for the early detection of potential complications, including renal dysfunction, or developing infections (18).

The routine use of urinary catheters in these clinical scenarios has, however, been increasingly critiqued due to concerns over associated risks and the necessity of such interventions. Research indicates that up to half of the urinary catheters placed in hospitals may lack an appropriate clinical indication, underscoring the need for alternative urine monitoring methods that can minimize or eliminate unnecessary catheterization (19). Moreover, evidence suggests that, particularly in cases of short-duration surgeries (< three hours) with minimal postoperative mobility restrictions, the risks associated with urinary catheterization may outweigh its benefits (20). Despite this, there remains a lack of standardized protocols regarding the insertion and removal of urinary catheters, leading to variability in practice and potentially unnecessary catheter use. This variability highlights the need for clearer guidelines and more individualized patient care strategies to mitigate the risks associated with prolonged urinary catheter use (21).

Role of nurses and patients

Given the importance of urinary monitoring and the significant risks associated with urinary catheterization, optimizing its use in clinical practice is crucial (22). Achieving optimization requires a multifaceted approach, including the development of clearer clinical guidelines, the implementation of alternative urine monitoring methods, and the empowerment of both nurses and patients in the decision-making process (23). Nurses have historically played a central role in urine monitoring and urinary catheter management, from insertion to maintenance and removal (24). In the modern healthcare setting, their responsibilities have expanded to educating patients about the risks associated with catheterization and ensuring adherence to best practices to prevent complications, such as urinary tract infections (25). Traditionally, the decision to insert a urinary catheter has been made by physicians. However, there is growing recognition of the impor-

tance of involving nurses in this decision-making process due to their clinical expertise and close contact with patients (26). Granting nurses greater autonomy in managing urinary catheters, including making decisions about their placement and removal, could lead to more timely and appropriate interventions, thereby reducing complications and enhancing patient comfort (27).

This expansion of nursing roles aligns with the increasing emphasis on patient participation in their own care. Engaging patients as active stakeholders in decision-making processes has been shown to improve health outcomes, increase patient satisfaction, and optimize healthcare resource use (28). Despite the shift towards patient-centered care, there remains a significant gap in effectively involving patients in urine monitoring and decisions regarding urinary catheter use, as research in this area remains relatively limited.

Conclusion
The evolving roles of nurses and patients in postoperative care present both challenges and opportunities. By redefining these roles and fostering a collaborative approach to care, healthcare systems can improve patient outcomes, enhance the efficiency of care delivery, and create a more patient-centered healthcare environment. This dissertation aims to explore these themes in the context of neurosurgical care, focusing on urinary monitoring and the management of urinary catheters as key areas where expanded nursing roles and patient participation can make a significant impact. Through a series of studies and a review, this dissertation will provide valuable insights into the factors influencing urinary monitoring, urinary catheter management decisions, the experiences and perspectives of patients, and the effectiveness of strategies aimed at optimizing postoperative care.

Aims and Thesis Outline
The objective of this thesis is to optimize urine monitoring and urinary catheterization after transsphenoidal pituitary and spondylodesis surgery, with a focus on reducing postoperative complications and enhancing the roles of both nurses and patients in care management. For this purpose, the following specific research questions were formulated:

1. How do clinical factors, healthcare professionals' and patients' experiences, and existing literature inform optimal strategies for IDUC management after transsphenoidal pituitary and general surgery?
2. What is the role of patient involvement in postoperative care, specifically in the context of urinary monitoring and the detection of AVP-D?
3. How effective are de-implementation strategies in reducing unnecessary urinary catheter use and associated complications after transsphenoidal pituitary and spondylodesis surgeries?

The first chapters of this dissertation delve into various aspects of IDUC management. These sections provide a comprehensive overview of insights from healthcare professionals, patient perspectives, and a systematic review of the literature.

Chapter 2 focuses on exploring the complex decision-making processes behind the removal of IDUCs after transsphenoidal pituitary surgery. This chapter aims to provide valuable insights from healthcare professionals regarding the factors influencing these critical decisions. **Chapter 3** presents a qualitative study capturing patient perspectives on the use of IDUCs and the management of fluid balances after transsphenoidal pituitary surgery. This chapter sheds light on the experiences and views of patients,

with the goal of enhancing postoperative care. **Chapter 4** offers a systematic review of the impact of early postoperative IDUC removal after a broad range of operations. This chapter synthesizes existing research to evaluate the optimal timing for IDUC removal and its effects on patient outcomes.

The subsequent chapters shift focus towards strategies aimed at improving perioperative care and reducing complications associated with urinary catheter use in both pituitary and spondylodesis surgeries. **Chapter 5**, outlines a mixed-methods multicentre study protocol for the de-implementation of urinary catheters during surgery and on the ward. This chapter aims to assess how reducing urinary catheter use impacts patient outcomes, contributing to safer and more effective perioperative care. **Chapter 6** reports the implementation of a standardized protocol for urinary catheter placement in a multicentre before-and-after study. This chapter evaluates the safety, feasibility, and outcomes of this protocol, aiming to improve postoperative care and reduce unnecessary catheterizations.

Finally, the dissertation addresses the importance of patient empowerment and participation in managing postoperative AVP-D after transsphenoidal pituitary surgery. **Chapter 7** focuses on patient involvement by addressing how simplifying specific gravity measurements can empower patients to take an active role in preventing AVP-D. This chapter highlights the importance of patient participation in collaborating with nurses.

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