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Nephrostomy tube dislodgement and emergency exchange: a study of clinical and age-related patient factors

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Introduction Unplanned nephrostomy tube exchange is common, yet patient-level risk factors remain poorly defined. This study aimed to quantify emergency exchange rates and identify clinical and vulnerability-related predictors.

Material and methods Adult patients undergoing nephrostomy placement or exchange in the period January 2021 to October 2024 were retrospectively reviewed. The first (index) procedure per patient was analyzed with up to 90-day follow-up. The primary outcome was emergency tube exchange; patency was time to emergency exchange. Multivariable logistic regression and Cox models identified associated factors.

Results A total of 108 patients were included; median age was 78 years (IQR 68–85) and 65% were male. Frailty (Clinical Frailty Scale ≥5) was present in 32%, and cognitive impairment in 10%. During follow-up, 49 patients (45%) required emergency exchange. The most common indications were partial dislodgement (49%), complete displacement (27%), and catheter obstruction (12%). Estimated tube patency was 70% at 30 days, 62% at 60 days, and 56% at 90 days. On multivariable logistic regression, cognitive impairment was independently associated with emergency exchange (OR 4.8, 95% CI: 1.1–21.0; p = 0.038). Age, sex, frailty, comorbidity burden, laterality, and functional dependence were not significantly associated. In Cox regression, cognitive impairment was also associated with reduced nephrostomy patency (HR 3.1, 95% CI: 1.3–7.2; p = 0.01).

Conclusions Emergency nephrostomy tube exchange is frequent. Cognitive impairment is a key patient-level risk factor for both emergency exchange and reduced tube patency.

Key Words: nephrostomy ‹› exchange ‹› emergency ‹› urology ‹› cognitive impairment

INTRODUCTION

The percutaneous nephrostomy allows for drainage of the upper urinary tract [1]. It is used for several indications, including as an exit strategy after percutaneous nephrolithotomy, the management of ureteric injury, and in both benign and malignant obstruction [2]. While it can serve as a temporizing measure, it can also represent a long-term means of urinary diversion for many patients. While major complications are known to occur and have been documented in the literature, they are relatively uncommon, and as such nephrostomy placement is associated with a low morbidity profile [3–6]. While local practice patterns vary, three months is a common time point for scheduled exchanges [7]. Problems do occur, however, including the need for emergency exchange as a result of, for example, tube dislodgement. In a study of the US Merative™ MarketScan Commercial Claims and Encounters

Databases, 24% of 19,689 exchanges were carried out on a non-routine basis [8]. This represents a scenario that many clinicians encounter on a regular basis [9]. Simultaneously, the multifactorial overarching syndrome of accelerated aging is expected to increase significantly worldwide as a consequence of the aging population [10], and there is a lack of research investigating percutaneous nephrostomies in this respect. Among the studies that have been performed, the focus has largely been on radiological and anatomical factors such as renal parenchymal thickness and psoas muscle area, or on technical aspects such as catheter design [11–14]. In contrast, patient and vulnerability factors such as chronological age, frailty, and functional independence are poorly explored.

The aim of this study was to assess the frequency of emergency nephrostomy tube exchanges and to identify clinical and patient-related factors associated with emergency exchange and reduced tube patency.

MATERIAL AND METHODS

Study design and population

This retrospective cohort study included adult patients undergoing nephrostomy-related procedures between January 2021 and October 2024. Eligible patients had percutaneous nephrostomy placement or nephrostomy tube exchange, with elective exchanges typically scheduled at approximately 90-day intervals. All underlying indications for percutaneous nephrostomy were eligible for inclusion. After application of predefined inclusion criteria and exclusion of cases with incomplete clinical data, 108 patients were included in the final analysis.

For patients undergoing multiple nephrostomy-related procedures during the study period, only the first (index) procedure per patient was included. The index event was defined as the first nephrostomy-related procedure during the study period, which could represent either initial nephrostomy placement or nephrostomy tube exchange.

Follow-up was measured from the time of this index procedure and continued for up to 90 days or until emergency nephrostomy tube exchange, elective removal, or planned exchange, whichever occurred first. At the time of index procedure, patients either underwent initial nephrostomy placement or had established nephrostomies undergoing exchange.

Data collection

Collected variables included age, sex, nephrostomy laterality, indication for nephrostomy placement, tube size, and duration of nephrostomy prior to exchange. Comorbidity burden was assessed using the age-adjusted Charlson Comorbidity Index (ACCI). Frailty was measured using the Rockwood Clinical Frailty Scale (CFS) and categorized as non-frail (≤4) or frail (≥5). Cognitive impairment was identified based on documented clinical diagnoses. Living situation and functional independence in activities of daily living were also recorded.

Outcomes

Emergency nephrostomy tube exchange was defined as any unplanned exchange prompted by tube-related complications. Indications for emergency exchange were categorized. Nephrostomy tube patency was defined as time from index exchange to emergency exchange.

Statistical analysis

Nephrostomy tube patency was analyzed using Kaplan–Meier survival analysis, with emergency nephrostomy tube exchange defined as the event of interest. Nephrostomies that were electively removed or exchanged as part of planned care, or where follow-up ended due to patient death, were censored at the time of removal or death and were not considered failures. Cox proportional hazards regression was used to assess factors associated with time to emergency exchange. Multivariable logistic regression was used to identify factors associated with the occurrence of emergency exchange. All analyses were conducted at the patient level. A p-value <0.05 was considered statistically significant. Statistical analyses were performed using IBM SPSS Statistics (v29.0). Figures were subsequently generated using Python (v3.13) for visualization.

Technical considerations

All nephrostomy procedures were performed by consultant interventional radiologists in a hospital setting. Exchange procedures were typically performed under fluoroscopic guidance, with ultrasound used when a new tract was required. Standard guidewire-assisted techniques were employed in accordance with local practice. The standard nephrostomy catheter used at our institution is the SKATER™ All-Purpose and Nephrostomy Drainage Catheter. The catheter includes an internal locking mechanism and is otherwise secured to the skin using standard dressings.

Bioethical standards

The study was conducted at Haukeland University Hospital, a tertiary referral center in Western Norway, in collaboration with the Clinical Research in Aging and NEphro-urology (CRANE) group. The study was formally registered as a clinical audit and, in accordance with institutional and national regulations, was exempt from the requirement for ethical approval.

RESULTS

Study population

A total of 108 patients were included, each contributing a single index nephrostomy tube procedure. The median age was 78 years (IQR 68–85), and 70 patients (64.8%) were male (Table 1). Nephrostomies were unilateral in 74 patients (68.6%) and bilateral in 34 patients (31.4%). The median ACCI was 7 (IQR 5–9). Thirty-four patients (31.5%) were classified as frail (CFS ≥5). Cognitive impairment was documented in 11 patients (10.2%). Most patients lived at home (62 patients, 57.4%), while 33 patients (30.6%) received home nursing care, and 13 patients (12.0%) resided in nursing homes. At the time of index exchange, 61 patients (56.5%) were undergoing their first exchange.

Emergency nephrostomy tube exchange

Of the 108 index nephrostomy tube procedures, 49 patients (45.4%) required emergency exchange during follow-up. Among emergency exchanges (n = 49), partial tube displacement was the most common indication (24 cases, 49.0%), followed by complete displacement (13 cases, 26.5%) and catheter blockage (6 cases, 12.2%). Less frequent indications included macrohaematuria (2 cases, 4.1%) and infection (1 case, 2.0%). In cases of complete displacement, a new nephrostomy tract was required, and successful tube placement was achieved in all cases.

Nephrostomy tube patency

Kaplan–Meier analysis demonstrated estimated nephrostomy tube patency rates of 70% at 30 days, 62% at 60 days, and 56% at 90 days. Emergency nephrostomy tube failure occurred predominantly early after placement, with a lower conditional risk of failure among tubes remaining patent beyond the first 60 days. Of note, the 90-day patency estimate reflects time-to-event analysis accounting for elective tube removal or exchange.

There was no significant difference in emergency exchange rates between patients with unilateral and bilateral nephrostomies (44.6% vs 47.1%, p = 0.9), nor between patients who were functionally independent and those dependent in activities of daily living (48.4% vs 41.3%, p = 0.4).

Factors associated with emergency exchange and reduced patency

On multivariable logistic regression analysis, cognitive impairment was independently associated with emergency nephrostomy tube exchange (OR 4.8, 95% CI: 1.1–21.0; p = 0.038). Age, sex, comorbidity burden, frailty status, nephrostomy laterality, and functional dependence were not significantly associated with emergency exchange.

Table 1. *Patient characteristics*

Study population characteristics	N (%)
Age, years (IQR)	78 (68–85)
Male-to-female ratio	1.8 : 1
Nephrostomy side:	
Left	37 (34.3)
Right	37 (34.3)
Bilateral	34 (31.4)
ACCI, median (IQR)	7 (5–9)
CFS:	
≤4	74 (68.5)
≥5	34 (31.5)
Formal diagnosis of cognitive impairment	11 (10.2%)
Residential status:	
Independent at home	62 (57.4)
Nursing assistance at own home	33 (30.6)
Nursing home	13 (12.0)
Indication for PCN:	
Benign urological cause	44 (40.7)
Urological malignancy	24 (22.2)
Malignancy of non-urological etiology	14 (12.9)
Radiation sequelae	14 (12.9)
Iatrogenic	2 (1.9)
Other	10 (9.3)
Nephrostomy tube size (Fr):	
8	2 (1.8)
10	105 (97.2)
12	1 (0.9)
Indication for emergency exchange:	
Partial displacement	24 (49)
Complete displacement	13 (26.5)
Blockage	6 (12.2)
Malfunctioning catheter	2 (4.1)
Macrohematuria	2 (4.1)
Infection	1 (2.0)
Other	1 (2.0)

ACCI – age adjusted Charlson comorbidity index; CFS – Clinical Frailty Scale; IQR – interquartile range; PCN – percutaneous nephrostomy

Kaplan–Meier analysis demonstrated a significantly higher cumulative risk of emergency exchange among patients with cognitive impairment (log-rank p = 0.03) (Figure 1). On multivariable Cox proportional hazards regression, cognitive impairment was also associated with reduced nephrostomy tube patency (HR 3.1, 95% CI: 1.3–7.2; p = 0.01).

DISCUSSION

The main finding of this cohort study was that cognitive impairment was associated with a significantly higher likelihood of emergency nephrostomy tube exchange, as well as a shorter patency. Cognitive impairment in addition to hearing and vision impairment, prevalent in the ageing population, can affect concentration, memory, decision-making, and problem-solving, and may influence an older adult's compliance to treatment [15, 16]. These findings suggest that patients with cognitive impairment may represent a higher-risk group for nephrostomy-related complications and may benefit from closer monitoring. The relatively small number of patients with documented cognitive impairment in our study may reflect cautious clinical selection for nephrostomy management already. While this association is clinically intuitive, to our knowledge, it has not been clearly demonstrated in prior studies. Notably, the wide confidence intervals indicate uncertainty in the effect estimate, and these findings should therefore be interpreted with caution and considered hypothesis-generating. It is acknowledged that suitable alternatives may be limited in some cases, and that ureteral stenting may introduce a different set of both challenges and complications. However, the growing practice of ureteral stent placement under local anesthesia in an outpatient setting, rather than under spinal or general anesthesia, may represent a potential alternative in selected patients [17, 18]. In addition, the formal use of a cognitive screening tool during admissions could be valuable because such assessments are often not performed routinely in surgical settings. Interestingly, the presence of bilateral nephrostomies was not associated with a significantly increased likelihood of emergency exchange, despite an anticipated increase in complexity.

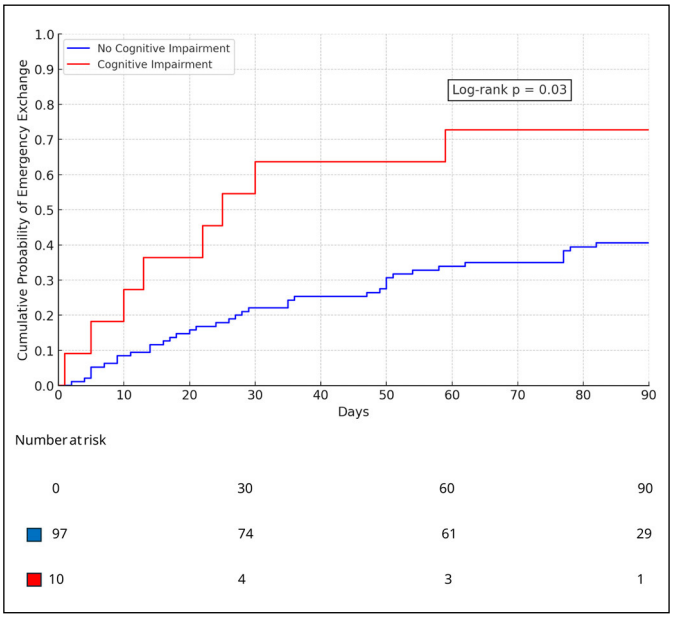

Figure 1. *Cumulative probability of emergency nephrostomy exchange by cognitive impairment status.*

Analysis of nephrostomy tube patency over time demonstrated a time-dependent pattern. Nephrostomies that remained patent beyond the first 60 days had a high likelihood of continued patency to 90 days (approximately 90%), highlighting an early period of increased vulnerability to failure. This could also prompt clinicians to consider whether patients experiencing early failure should be managed with shorter exchange intervals or whether nephrostomy is an appropriate option at all.

Although this study did not include a cost analysis, it is anticipated that the overall economic burden would be lower compared with repeated emergency admissions. From a quality-of-life perspective, planned admissions are also likely to impose a lower burden than emergency or out-of-hours interventions. Elliott et al. [19] reported that nursing-led educational programs were associated with an approximately 20% reduction in subsequent resource consumption. A nurse-led nephrostomy clinic has also previously been described by Zhu et al. Although applied in a pediatric setting, Wang et al. reported a pilot study using a magnetic device with an electronic sensor to detect catheter displacement, which was connected to a nurse monitoring terminal at the hospital [20]. This early warning system resulted in a significantly lower risk of catheter-related complications, such as displacement. Preventive strategies may therefore include better patient and caregiver education, closer follow-up in higher-risk patients, and attention to catheter care and fixation.

Frailty is associated with worse outcomes in many settings and in all age groups [10, 21, 22]. It could therefore be expected to have a similar impact in this context. However, this was not observed. The provision of additional home support and more limited physical activity may be protective.

The median age of 78 years reflects the demographic most commonly burdened with nephrostomies. Similar to our findings, a study by Khuhelj et al. [13] did not identify age as a predictor of displacement. Nonetheless, the proportion of older patients requiring nephrostomies is likely to increase given the known population aging trends. Consequently, strategies to improve the nephrostomy management pathway, particularly for this demographic, are of growing relevance. A detailed holistic assessment, such as the Comprehensive Geriatric Assessment [23], may be relevant. Furthermore, a recent systematic review showed a potential link between individual-focused health literacy interventions and positive health literacy-related outcomes in relation to older persons' ability to understand and use health information in general [24, 25].

There are several limitations to acknowledge in this study. The study population was heterogeneous with respect to underlying indications, which may be associated with differing risks of complications and outcomes. Subgroup analyses were not performed due to limited sample size and the risk of underpowered comparisons. The cohort included patients undergoing their first nephrostomy exchange following initial placement, as well as those with established nephrostomies and prior exchanges, which may introduce heterogeneity into the analysis. The small sample size, particularly the limited number of patients with cognitive impairment, resulted in a low events-per-variable ratio, with potential impact on estimate stability and confidence intervals. The time interval between nephrostomy-related complications and patient presentation was not consistently documented and could not be analyzed. This factor may influence procedural success and represents an important area for future prospective study.

Most studies addressing quality-of-life burden focus on younger patients with stone disease, in whom nephrostomy placement is typically temporary. In contrast, older patients requiring long-term nephrostomy management remain relatively understudied. Future studies should be prospective and multicenter, with larger sample sizes, longer follow-up, and inclusion of patient-reported outcomes to assess quality of life. This study focuses on patient-level factors; further research is also needed to evaluate technical factors such as dressing and fixation methods.

CONCLUSIONS

Emergency nephrostomy exchanges are common. Cognitive impairment is associated with an increased risk of emergency exchange and shorter patency. These findings suggest that patients with cognitive impairment may represent a higher-risk group for nephrostomy-related complications and may benefit from closer monitoring.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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ETHICS APPROVAL STATEMENT

The ethical approval was not required.

References

1. Dagli M, Ramchandani P. Percutaneous nephrostomy: technical aspects and indications. Semin Intervent Radiol. 2011; 28: 424-437.
2. Talyshinskii A, Tzelves L, Juliebø-Jones P, et al. The Evolution of Percutaneous Nephrolithotripsy- An Overview from European Association of Urology Endourology Section. J Endourol. 2025; 39: 985-997.
3. Radecka E, Magnusson A. Complications associated with percutaneous nephrostomies. A retrospective study. Acta Radiol. 2004; 45: 184-188.
4. Lewis S, Patel U. Major complications after percutaneous nephrostomy-lessons from a department audit. Clin Radiol. 2004; 59: 171-179.
5. Zaman F, Alam K, Buchholz N, Masood J. The UK nephrostomy audit. Can a voluntary registry produce robust performance data? Clin Radiol. 2009; 64: 847-849.
6. Akatsuka J, Suzuki Y, Endo Y, et al. Nephrostomy catheter entering the right renal vein during an exchange procedure: A case report and literature review. IJU Case Rep. 2021; 4: 168-171.
7. Hu T, Zhang N, Kovoor J, Sutphin P, Kalva S, Pillai A. Comparative evaluation of non-procedural nephrostomy tube related complications in patients with ureteric obstruction due to cancer versus other causes: is 3 month nephrostomy tube (PCN) exchanges optimal for both disease processes? J Vasc Interv Radiol. 2016; 27: S133-S134.
8. Moon JT, Nguyen J, Ricci J, et al. Analysis of percutaneous nephrostomy exchange intervals: insights from a retrospective Merative MarketScan analysis between 2009-2021. World J Urol. 2024; 42: 424.
9. Pabon-Ramos WM, Dariushnia SR, Walker TG, et al. Quality Improvement Guidelines for Percutaneous Nephrostomy. J Vasc Interv Radiol. 2016; 27: 410-414.
10. Kim DH, Rockwood K. Frailty in Older Adults. N Engl J Med. 2024; 391: 538-548.
11. Dablan A, Okur Z, Cingöz M, et al. Predictors of Nephrostomy Catheter Dislodgement: Insights from a Retrospective Analysis. Cardiovasc Intervent Radiol. 2025; 48: 633-642.

12. Panach-Navarrete J, Tonazzi-Zorrilla R, Martínez-Jabaloyas JM. Dislodgement in Long-Term Patients with Nephrostomy Tube: Risk Factors and Comparative Analysis Between Two Catheter Designs. J Endourol. 2020; 34: 227-232.

13. Kuhelj D, Sustersic A, Zdesar U. The influence of catheter type, the number of sutures and patients' age on percutaneous nephrostomy displacement. Radiol Oncol. 2025; 59: 522-525.

14. Millar-Mills M, Bhatt D, Gibson M, et al. The Hub-Suture: A Novel Technique for Securing a Nephrostomy Tube to Reduce Drain Dislodgment. J Vasc Interv Radiol. 2023; 34: 726-729.

15. Guthrie DM, Davidson JGS, Williams N, et al. Combined impairments in vision, hearing and cognition are associated with greater levels of functional and communication difficulties than cognitive impairment alone: Analysis of interRAI data for home care and long-term care recipients in Ontario. PLoS One. 2018; 13: e0192971.

16. Davidson JGS, Guthrie DM. Older Adults With a Combination of Vision and Hearing Impairment Experience Higher Rates of Cognitive Impairment, Functional Dependence, and Worse Outcomes Across a Set of Quality Indicators. J Aging Health. 2019; 31: 85-108.

17. Nourparvar P, Leung A, Shrewsberry AB, et al. Safety and Efficacy of Ureteral Stent Placement at the Bedside Using Local Anesthesia. J Urol. 2016; 195: 1886-1890.

18. Gordon P, Thompson D, Patel O, Ma R, Bolton D, Ischia J. Ureteric stenting outside of the operation theatre: challenges and opportunities. BJU Int. 2025; 135: 204-213.

19. Elliott ED. Nursing Care and Considerations for Patients with Percutaneous Nephrostomy Tubes. Urologic Nursing. 2025;45(1).

20. Chen Y, Wang Y, Zhu S, Yuan J, Zong W. An At-Home Monitoring Device and Remote Nursing Protocol to Prevent Nephrostomy Tube Dislodgement in Children: A Single-Center Retrospective Study. J Endourol. 2025; 39: 917-923.

21. Juliebø-Jones P, Tsaturyan A, Emiliani E, et al. Frailty scoring systems in urological surgery: Current status and future perspectives. Urol Ann. 2025; 17: 218-222.

22. Street A, Maynou L, Blodgett JM, Conroy S. Association between Hospital Frailty Risk Score and length of hospital stay, hospital mortality, and hospital costs for all adults in England: a nationally representative, retrospective, observational cohort study. Lancet Healthy Longev. 2025; 6: 100740.

23. Parker SG, McCue P, Phelps K, et al. What is Comprehensive Geriatric Assessment (CGA)? An umbrella review. Age Ageing. 2018; 47: 149-155.

24. Marshall N, Butler M, Lambert V, Timon CM, Joyce D, Warters A. Health literacy interventions and health literacy-related outcomes for older adults: a systematic review. BMC Health Serv Res. 2025; 25: 319.

25. Norekvål TM, Andersen H, Instenes I, Kirk BH, Titlestad I, Eide LSP. Practical guidance for conducting research with older adults: creating reliable evidence to improve care. Eur J Cardiovasc Nurs. 2026; 25: 416-422.