CTCAE-Guided Management of Cytotoxic Chemotherapy Toxicity in Uro-Oncology: A Contemporary Narrative Review

Minh Nguyet Tranová[1,2], Oleg Izmaylov[1,2], Hanka Princlová[1,2], Pavel Navrátil[1,2,*]

ABSTRACT

Cytotoxic chemotherapy remains integral to contemporary uro-oncology despite the rapid expansion of targeted therapy, antibody-drug conjugates, and immunotherapy. Its role is especially critical where therapeutic success depends on maintaining adequate dose intensity, most notably in metastatic testicular germ cell tumours and in cisplatin-based perioperative treatment for muscle-invasive bladder cancer. In metastatic prostate cancer and selected penile squamous cell carcinoma, taxane- and platinum-based regimens also retain clinical value but are constrained by hematologic, neurologic, renal, pulmonary, and gastrointestinal toxicities. This narrative review summarises current evidence and guideline recommendations for Common Terminology Criteria for Adverse Events (CTCAE)-guided management of chemotherapy toxicity across major uro-oncologic disease settings. A practical emphasis is placed on pretreatment risk stratification, cycle-by-cycle surveillance, supportive care, and intent-adapted treatment modification. Across tumour types, early recognition of grade 2 toxicity, urgent management of febrile neutropenia and organ toxicity, and thoughtful preservation of dose intensity when cure is realistic are the central management principles. In older, frail, immunosuppressed, heavily pretreated, or organ-limited patients, CTCAE grades must be interpreted against baseline reserve and cumulative toxicity.

KEYWORDS

uro-oncology; CTCAE; chemotherapy toxicity; germ cell tumour; urothelial carcinoma; prostate cancer; penile cancer

AUTHOR AFFILIATIONS

[1] Department of Urology, University Hospital Hradec Králové, Hradec Králové, Czech Republic
[2] Charles University, Faculty of Medicine in Hradec Králové, Hradec Králové, Czech Republic
* Corresponding author: Department of Urology, University Hospital Hradec Králové, Sokolská 581, 500 05 Hradec Králové, Czech Republic; pavel.navratil2@fnhk.cz

Received: 22 March 2026
Accepted: 24 April 2026
Published online: 11 August 2026

Acta Medica (Hradec Králové) 2026; 69(2): 65–71
https://doi.org/10.14712/18059694.2026.20

INTRODUCTION

Although uro-oncology is increasingly shaped by precision medicine and immunotherapy, conventional cytotoxic chemotherapy remains indispensable in several major disease states. In metastatic testicular germ cell tumours, cisplatin-based treatment remains one of the clearest examples of curative systemic therapy in solid oncology (1–3). In muscle-invasive and metastatic urothelial carcinoma, platinum-based chemotherapy continues to define perioperative and first-line systemic treatment for appropriately selected patients (4–7). In metastatic prostate cancer, docetaxel and cabazitaxel remain clinically important across hormone-sensitive and castration-resistant settings (8–12). In penile squamous cell carcinoma, cisplatin- and taxane-based regimens still have a role in selected men with bulky nodal disease (13, 14).

The clinical problem is not only whether chemotherapy should be used, but whether it can be delivered safely and on schedule. Many of the most effective regimens in uro-oncology are also among the most toxic. Platinum agents challenge renal function, hearing, and peripheral nerves; bleomycin can injure the lung; taxanes produce marrow suppression, neuropathy, and nail toxicity; and multidrug combinations create overlapping risks of infection, dehydration, and hospitalisation.

The Common Terminology Criteria for Adverse Events (CTCAE) evolved from the National Cancer Institute Common Toxicity Criteria, introduced primarily to standardise adverse-event reporting in clinical trials. Over successive versions, the framework expanded from a research reporting instrument into a shared language that is also routinely used to structure bedside assessment, interprofessional communication, protocol-defined dose modification, and supportive care (15).

CTCAE version 6.0, released by the National Cancer Institute in 2025, retains the familiar five-grade framework but updates the terminology to MedDRA 28.0 and addresses specific limitations of version 5.0. The principal improvements highlighted by the National Cancer Institute include grading adverse events in patients with abnormal baseline laboratory values, better characterisation of events associated with immunotherapeutics, and refined categorisation of cardiac adverse events. A comprehensive mapping of term-and-grade combinations from version 5.0 to version 6.0 was also developed to support implementation and longitudinal comparison (16, 17). Although the present review focuses on cytotoxic chemotherapy, these changes are clinically relevant because they improve baseline-aware interpretation and reduce ambiguity when patients receive sequential or combined systemic treatments.

The aim of this review is to summarise contemporary evidence for CTCAE-guided management of cytotoxic chemotherapy toxicity in uro-oncology, with emphasis on disease-specific priorities, cross-cutting toxicity domains, and a practical intent-adapted approach to treatment continuation, delay, modification, or discontinuation. Its intended contribution is an integrated framework spanning multiple uro-oncologic disease settings rather than a catalogue of isolated drug-specific adverse events.

MATERIAL AND METHODS

This article was prepared as a narrative review. The core conceptual framework was based on CTCAE version 6.0 (16), the 2026 European Association of Urology (EAU) guidelines for testicular cancer, muscle-invasive and metastatic bladder cancer, prostate cancer, and penile cancer (1, 4, 8, 13), and contemporary supportive-care recommendations for chemotherapy-induced nausea and vomiting and febrile neutropenia (18, 19).

Landmark clinical studies were selected when they materially shaped current regimen choice, toxicity expectations, or supportive-care decision making in uro-oncology (2, 3, 5–7, 9–12, 14, 20–23). Additional cross-cutting literature was reviewed for older and frail adults, baseline immunosuppression, cumulative toxicity, and impaired organ reserve. The scope of the review was restricted to cytotoxic chemotherapy and immediately related supportive care. Immunotherapy, targeted therapy, and antibody-drug conjugates were discussed only when necessary to contextualise the continuing role of chemotherapy in current practice.

RESULTS

ROLE OF CTCAE V6.0 IN URO-ONCOLOGY

CTCAE version 6.0 preserves the familiar five-grade severity framework while refining adverse-event definitions and maintaining a clinically intuitive hierarchy from mild toxicity to treatment-related death (16, 17). In practical uro-oncology, the utility of CTCAE lies in the fact that the action threshold often sits at grade 2 rather than grade 3. Waiting until organ toxicity, neuropathy, dehydration, or cytopenia becomes severe is rarely good bedside management when curative or survival-prolonging treatment depends on schedule adherence.

CTCAE is most useful when interpreted in the context of treatment intent. For example, a moderate creatinine rise during neoadjuvant cisplatin for muscle-invasive bladder cancer should trigger vigorous supportive intervention and short-interval reassessment rather than immediate abandonment of cisplatin. By contrast, recurrent grade 2 or irreversible grade 3 neuropathy during later-line palliative taxane therapy may justify earlier dose reduction or discontinuation. Proper CTCAE-based grading therefore improves both reproducibility and the quality of clinical judgement (Table 1).

Tab. 1 Contemporary chemotherapy platforms in uro-oncology and their dominant toxicity priorities.

Disease setting	Core cytotoxic regimens still relevant in practice	Typical treatment intent	Dominant toxicity concerns	Key baseline assessments
Metastatic testicular GCT	BEP; EP	Curative	Nephrotoxicity, bleomycin pneumonitis, neuropathy/ototoxicity, febrile neutropenia, fertility and vascular late effects	Complete blood count, creatinine/eGFR, magnesium, pulmonary history, neuropathy/hearing history, fertility counselling
Muscle-invasive / metastatic urothelial carcinoma	dd-MVAC; gemcitabine-cisplatin; selected carboplatin-based alternatives	Perioperative survival gain or palliative disease control	Renal injury, febrile neutropenia, mucositis, severe CINV, neuropathy/ototoxicity	Performance status, creatinine clearance, complete blood count, hydration status, neuropathy/hearing assessment
Metastatic prostate cancer	Docetaxel; cabazitaxel	Disease control / survival prolongation	Neutropenia, febrile neutropenia, fatigue, neuropathy, nail toxicity, diarrhoea	Complete blood count, infection risk, functional status/frailty, bowel function, neuropathy history
Bulky nodal penile squamous cell carcinoma	TIP; other cisplatin-taxane combinations in expert centres	Neoadjuvant downstaging	Myelosuppression, nephrotoxicity, neuropathy, emesis, ifosfamide-related complexity	Complete blood count, renal function, infection status, performance status, neuropathy screen

Abbreviations: BEP = bleomycin, etoposide, cisplatin; CINV = chemotherapy-induced nausea and vomiting; dd-MVAC = dose-dense methotrexate, vinblastine, doxorubicin, cisplatin; eGFR = estimated glomerular filtration rate; EP = etoposide, cisplatin; GCT = germ cell tumour; TIP = paclitaxel, ifosfamide, cisplatin.

DISEASE-SPECIFIC TOXICITY PRIORITIES

Metastatic testicular germ cell tumours

Metastatic germ cell tumours remain the prototypical curable malignancy treated with systemic chemotherapy. Current management continues to be anchored in the International Germ Cell Cancer Collaborative Group risk framework and in cisplatin-based regimens such as bleomycin, etoposide, and cisplatin (BEP) or etoposide and cisplatin (EP) (1–3). Because cure is realistic even in advanced disease, preservation of dose intensity is a central management principle.

Renal toxicity, hypomagnesaemia, peripheral neuropathy, ototoxicity, and febrile neutropenia are the most frequent treatment-limiting events. Prevention of cisplatin nephrotoxicity requires structured hydration, magnesium replacement, review of concomitant nephrotoxins, and early correction of vomiting or diarrhoea; contemporary evidence continues to support the renoprotective role of magnesium supplementation during cisplatin treatment (20). Bleomycin pulmonary toxicity remains the most characteristic germ-cell-tumour-specific complication and should be suspected early in the presence of cough, dyspnoea, or new interstitial changes (21). In this disease, supportive care is not separate from curative therapy; it is a prerequisite for cure.

Muscle-invasive and metastatic urothelial carcinoma

In urothelial carcinoma, toxicity management begins with patient selection. The classic concept of cisplatin unfitness remains clinically useful and incorporates impaired renal function, poor performance status, clinically meaningful neuropathy or hearing loss, and severe cardiac comorbidity (4, 6). Even as perioperative strategies evolve, contemporary practice continues to rely on cisplatin-based chemotherapy in appropriately selected fit patients.

The toxicity phenotype varies by regimen. Dose-dense methotrexate, vinblastine, doxorubicin, and cisplatin (dd-MVAC) with growth-factor support remains an important perioperative option but requires close surveillance, whereas gemcitabine-cisplatin is generally better tolerated than classic MVAC and remains foundational in advanced disease (4, 5, 7). Renal injury, mucositis, severe chemotherapy-induced nausea and vomiting, and febrile neutropenia are the dominant practical concerns. In curative-intent treatment, a short delay for renal optimisation is often preferable to premature dose fragmentation or inappropriate substitution.

Metastatic prostate cancer

Cytotoxic therapy in metastatic prostate cancer is dominated by taxanes. Docetaxel remains a standard option in selected men with metastatic hormone-sensitive disease and in metastatic castration-resistant prostate cancer, while cabazitaxel retains a key role after docetaxel exposure, particularly in patients progressing on androgen receptor pathway inhibitors (8–12).

The major dose-limiting toxicity of taxanes is marrow suppression, especially neutropenia and febrile neutropenia. Primary granulocyte colony-stimulating factor prophylaxis is therefore recommended or strongly considered in appropriate cabazitaxel-treated patients (8, 10–12). Peripheral neuropathy, fatigue, nail toxicity, and diarrhoea are the other clinically relevant toxicities. Emerging supportive-care data suggests that extremity cooling may reduce taxane-related nail changes and peripheral neuropathy and may be considered where available (22, 23).

Penile squamous cell carcinoma

Penile squamous cell carcinoma is rare, and the evidence base for chemotherapy is correspondingly limited. Nevertheless, contemporary guidelines continue to support neoadjuvant cisplatin- and taxane-based treatment in selected fit men with bulky mobile inguinal nodes or pelvic nodal disease, ideally in experienced centres (13).

The best-known prospective evidence comes from the phase II TIP regimen study, in which paclitaxel, ifosfamide, and cisplatin enabled meaningful downstaging and subsequent surgery in a substantial subset of patients (14). The toxicologic burden is considerable, combining myelosuppression, nephrotoxicity, neurotoxicity, emesis, and the supportive-care complexity of ifosfamide. In this setting, CTCAE-based prospective grading and a clearly defined toxicity plan before the first cycle are particularly important.

Cross-cutting toxicity domains

Several toxicities recur across uro-oncologic regimens and deserve a unified management strategy. Febrile neutropenia must always be treated as an oncologic emergency. CTCAE-based classification supports immediate escalation to cultures, empiric broad-spectrum antibiotics, haemodynamic assessment, and risk-adapted inpatient or outpatient management (16, 19).

Nephrotoxicity should be anticipated rather than discovered late. Cisplatin-associated kidney injury is often preceded by reduced oral intake, persistent emesis, orthostasis, and hypomagnesaemia. The most effective response pathway combines CTCAE laboratory thresholds with clinical context, structured hydration, and active medication review, particularly for non-steroidal anti-inflammatory drugs and renin-angiotensin system inhibitors (16, 20).

Pulmonary toxicity during bleomycin treatment requires a low threshold for intervention. Similarly, cumulative peripheral sensory neuropathy and ototoxicity should be documented longitudinally because reversal is often incomplete once clinically significant deficits are established (16, 21). Nausea, vomiting, mucositis, and diarrhoea should be viewed as operational toxicities because they disrupt hydration, nutrition, treatment adherence, and the ability to maintain dose intensity. Guideline-concordant antiemetic prophylaxis should therefore be implemented from the first cycle rather than after the first severe episode (18) (Table 2).

Tab. 2 CTCAE-oriented management matrix for high-impact chemotherapy toxicities in uro-oncology.

High-impact toxicity	Representative CTCAE v6.0 trigger(s)	Preferred action in curative-intent therapy	Preferred action in palliative therapy	Clinical notes
Creatinine increased / renal toxicity	Grade 2: >1.5–3.0 × upper limit of normal; grade 3: >3.0–6.0 × upper limit of normal	Urgent hydration and electrolyte review, hold treatment if persistent, re-challenge only after meaningful recovery	Lower threshold for regimen modification or agent switch	Always review vomiting, diarrhoea, nephrotoxic drugs, and magnesium depletion
Neutrophil count decreased / febrile neutropenia	Grade 3–4 neutropenia; febrile neutropenia = fever with absolute neutrophil count <1.0 × 10^9/L	Immediate sepsis-oriented management; prefer delay plus supportive care over empiric dose erosion when cure is realistic	Immediate management, then consider dose reduction or prophylactic G-CSF if treatment continues	Febrile neutropenia is an emergency, not a routine adverse effect
Peripheral sensory neuropathy	Grade 2 limits instrumental activities of daily living; grade 3 limits self-care activities	Escalate monitoring at grade 2; modify therapy only if persistent, progressive, or function-threatening	Dose reduction or discontinuation is appropriate earlier if function or quality of life is compromised	Document symptoms longitudinally rather than relying on a single yes/no question
Pulmonary toxicity during bleomycin	New cough, dyspnoea, imaging changes, or oxygen requirement	Stop bleomycin promptly, investigate, and treat; do not wait for advanced respiratory compromise	Usually discontinue the offending agent permanently	Clinical suspicion matters even before dramatic imaging abnormalities appear
Nausea, vomiting, and dehydration	Recurrent vomiting, poor oral intake, electrolyte loss, or hospital attendance	Optimise full antiemetic prophylaxis and hydration to preserve schedule intensity	Optimise symptom control; treatment breaks or de-escalation may be appropriate earlier	The downstream problem is often kidney injury and treatment delay rather than nausea alone

Practical CTCAE workflow

A practical CTCAE-guided workflow in uro-oncology has four major steps: define therapeutic intent before treatment begins, map baseline vulnerability, grade every relevant toxicity prospectively before each cycle, and match the intervention to both CTCAE grade and oncologic stakes. Responsibility for this pathway is shared: urologists define disease-specific and surgical priorities; medical oncologists lead systemic-treatment selection, dose modification, and treatment re-challenge; and oncology pharmacists, specialist nurses, and organ-specific consultants support prevention, monitoring, and toxicity management. In curative-intent therapy, grade 1 toxicity generally permits treatment continuation with reinforced supportive care; persistent or escalating grade 2 toxicity usually requires intensified intervention and often a brief delay; grade 3 toxicity typically requires treatment interruption and expert reassessment before resumption; and grade 4 toxicity usually mandates discontinuation of the offending agent unless an exceptional rationale for modified continuation exists (1, 4, 8, 13, 16).

In palliative settings, the same CTCAE grades apply, but the tolerance for repeated grade 2 or irreversible grade 3 toxicity should be lower because quality of life and preservation of function become dominant clinical objectives. The central principle is early detection, proportionate action, and transparent re-evaluation before the next cycle (Figure 1).

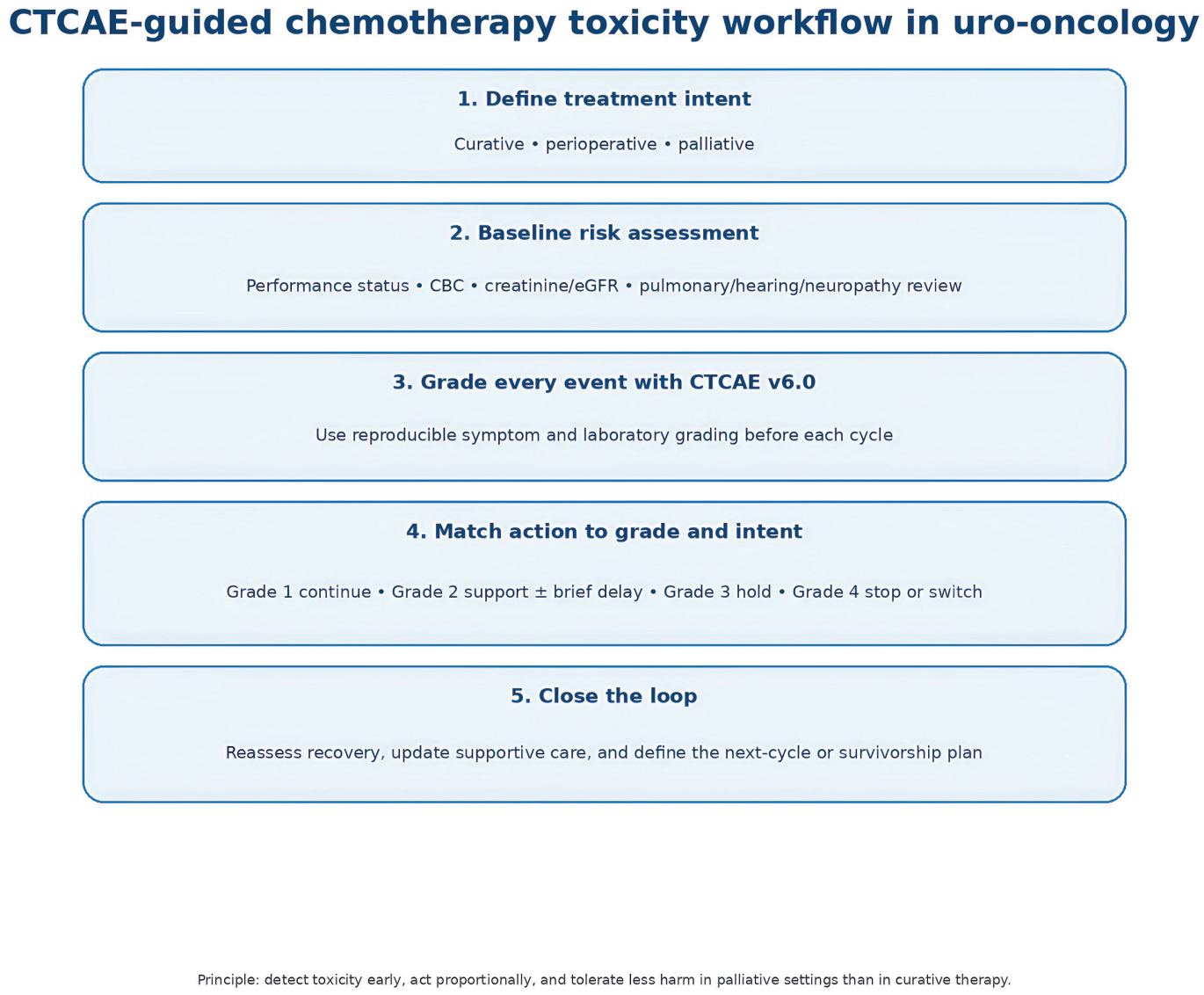

Fig. 1 Intent-adapted CTCAE workflow for chemotherapy toxicity management in uro-oncology.
The figure summarises a practical sequence: defines therapeutic intent, assess baseline vulnerability, grade toxicities prospectively, match the intervention to CTCAE grade and oncologic stakes, and reassess before the next cycle or survivorship planning.

Special patient populations and baseline vulnerability

CTCAE grade describes event severity but does not, by itself, describe physiologic reserve. The same grade 2 diarrhoea, fatigue, or neutropenia may have very different consequences in a fit young patient and in an older adult with frailty, falls, polypharmacy, cognitive impairment, malnutrition, or limited social support. For adults aged 65 years and older, a geriatric assessment covering physical function, cognition, nutrition, comorbidity, medications, psychological status, and social support should complement performance status. Vulnerabilities identified before chemotherapy should lead to targeted interventions, closer early-cycle surveillance, and, when appropriate, proactive regimen or supportive-care adaptation rather than reflexive undertreatment based on chronological age alone (24).

Patients with borderline renal, hepatic, marrow, cardiac, or pulmonary reserve require baseline values to be treated as part of the toxicity definition. A post-treatment result that remains within the population reference range can still represent a clinically meaningful decline from baseline, whereas a stable chronic abnormality should not automatically be attributed to chemotherapy. Drug-specific pharmacokinetics measured or appropriately estimated renal function, hepatic impairment, interacting medicines, and the reversibility of the deficit should guide re-challenge and dose selection (16, 17, 25). In heavily pretreated patients, cumulative neuropathy, ototoxicity, marrow exhaustion, and prior organ injury should be documented longitudinally; the decision threshold should reflect trajectory and functional effect, not only the highest grade recorded during the current cycle (26).

Baseline immunosuppression – because of solid-organ transplantation, autoimmune disease, prolonged corticosteroid exposure, or other causes – adds infection risk, drug–drug interactions, and, in transplant recipients, the competing risks of graft dysfunction and rejection. Evidence is limited and these patients are frequently excluded from prospective trials; chemotherapy should therefore be planned jointly with medical oncology and the relevant organ or transplant specialist, with explicit antimicrobial, interaction, and therapeutic-drug-monitoring plans where indicated (27). Across all special populations, CTCAE should function as a common language within a multidisciplinary team rather than as an automatic dose-reduction algorithm.

DISCUSSION

Across contemporary uro-oncology, the same management tension recurs: clinicians must control toxicity without unnecessarily compromising effective therapy. CTCAE offers a reproducible language for doing so, but its value depends on disciplined application. A grading system alone does not improve outcomes; improvement comes from linking grades to predefined clinical actions, documenting events prospectively, and interpreting them in light of therapeutic intent, baseline reserve, cumulative exposure, and patient priorities. Because these decisions frequently intersect with surgery, systemic therapy, infection management, and organ-specific care, they should be made within an explicit multidisciplinary framework that includes urology and medical oncology.

The practical implication is straightforward. In disease settings where cure or major survival gain is realistic, especially metastatic germ cell tumours and cisplatin-based perioperative therapy for urothelial carcinoma, supportive care should be used aggressively to preserve treatment intensity whenever clinically defensible. In later-line palliative therapy, especially taxane-based treatment in metastatic prostate cancer, repeated moderate toxicity may appropriately trigger earlier de-escalation. For older, frail, immunosuppressed, heavily pretreated, or organ-limited patients, the same nominal CTCAE grade may justify a different intervention because the probability and consequences of further deterioration are not equivalent. A CTCAE-guided approach is therefore not a rigid algorithm but a structured platform for intent- and vulnerability-adapted decision making.

This review has the limitations inherent to a narrative synthesis. It does not provide a formal systematic review or meta-analysis, and several recommendations necessarily reflect interpretation of guideline-based practice rather than direct comparative trials. Nevertheless, the central clinical message remains robust: consistent toxicity grading, careful baseline assessment, and early supportive intervention are essential components of safe and effective chemotherapy delivery in uro-oncology.

CONCLUSIONS

CTCAE version 6.0 provides a practical framework for modern toxicity management in uro-oncology. Its main value lies in improving reproducibility, multidisciplinary communication, and the timing of intervention, while its updated baseline-aware and terminology refinements improve interpretation across increasingly complex systemic-treatment pathways.

Across metastatic germ cell tumours, urothelial carcinoma, metastatic prostate cancer, and penile cancer, the critical question is rarely whether toxicity exists, but whether it is recognised early enough and managed in a way that matches the oncologic stakes. A CTCAE-guided and intent-adapted strategy should therefore be regarded as a core component of chemotherapy practice rather than ancillary supportive care.

REFERENCES

1. European Association of Urology. EAU Guidelines on Testicular Cancer. Edn. presented at the EAU Annual Congress London, 2026. Arnhem: EAU Guidelines Office; 2026. Available at: https://uroweb.org/guidelines/testicular-cancer (accessed March 22, 2026).
2. Gillessen S, Sauvé N, Collette L, et al. Predicting outcomes in men with metastatic nonseminomatous germ cell tumors (NSGCT): results from the IGCCCG Update Consortium. J Clin Oncol. 2021; 39: 1563–74.
3. Einhorn LH. Curing metastatic testicular cancer. Proc Natl Acad Sci USA. 2002; 99: 4592–5.
4. European Association of Urology. EAU Guidelines on Muscle-invasive and Metastatic Bladder Cancer. Edn. presented at the EAU Annual Congress London, 2026. Arnhem: EAU Guide-

lines Office; 2026. Available at: https://uroweb.org/guidelines/muscle-invasive-and-metastatic-bladder-cancer (accessed March 22, 2026).
5. Pfister C, Gravis G, Fléchon A, et al. Dose-dense methotrexate, vinblastine, doxorubicin, and cisplatin or gemcitabine and cisplatin as perioperative chemotherapy for patients with nonmetastatic muscle-invasive bladder cancer: results of the GETUG-AFU V05 VESPER trial. J Clin Oncol. 2022; 40: 2013–22.
6. Galsky MD, Hahn NM, Rosenberg J, et al. A consensus definition of patients with metastatic urothelial carcinoma who are unfit for cisplatin-based chemotherapy. Lancet Oncol. 2011; 12: 211–4.
7. von der Maase H, Hansen SW, Roberts JT, et al. Gemcitabine and cisplatin versus methotrexate, vinblastine, doxorubicin, and cisplatin in advanced or metastatic bladder cancer: results of a large, randomized, multinational, multicenter, phase III study. J Clin Oncol. 2000; 18: 3068–77.
8. European Association of Urology. EAU Guidelines on Prostate Cancer. Edn. presented at the EAU Annual Congress London, 2026. Arnhem: EAU Guidelines Office; 2026. Available at: https://uroweb.org/guidelines/prostate-cancer (accessed March 22, 2026).
9. Tannock IF, de Wit R, Berry WR, et al. Docetaxel plus prednisone or mitoxantrone plus prednisone for advanced prostate cancer. N Engl J Med. 2004; 351: 1502–12.
10. de Bono JS, Oudard S, Ozguroglu M, et al. Prednisone plus cabazitaxel or mitoxantrone for metastatic castration-resistant prostate cancer progressing after docetaxel treatment: a randomised open-label trial. Lancet. 2010; 376: 1147–54.
11. de Wit R, de Bono J, Sternberg CN, et al. Cabazitaxel versus abiraterone or enzalutamide in metastatic prostate cancer. N Engl J Med. 2019; 381: 2506–18.
12. Kimura S, Shigeta K, Tamura S, et al. Effectiveness and safety of primary prophylaxis of G-CSF during chemotherapy for prostate cancer, Japanese clinical guideline for appropriate use of G-CSF: clinical practice guidelines for the use of G-CSF 2022. Int J Clin Oncol. 2024; 29: 559–63.
13. European Association of Urology and American Society of Clinical Oncology. EAU-ASCO Guidelines on Penile Cancer. Edn. presented at the EAU Annual Congress London, 2026. Arnhem: EAU Guidelines Office; 2026. Available at: https://uroweb.org/guidelines/penile-cancer (accessed March 22, 2026).
14. Pagliaro LC, Williams DL, Daliani D, et al. Neoadjuvant paclitaxel, ifosfamide, and cisplatin chemotherapy for metastatic penile cancer: a phase II study. J Clin Oncol. 2010; 28: 3851–7.
15. Trotti A, Colevas AD, Setser A, et al. CTCAE v3.0: development of a comprehensive grading system for the adverse effects of cancer treatment. Semin Radiat Oncol. 2003; 13: 176–81.
16. National Cancer Institute. Common Terminology Criteria for Adverse Events (CTCAE), version 6.0 (MedDRA 28.0). Bethesda (MD): U.S. Department of Health and Human Services; 2025.
17. National Cancer Institute. NCI releases updated version of the Common Terminology Criteria for Adverse Events (CTCAE) reporting in clinical trials. Bethesda (MD): National Cancer Institute; 2026. Available at: https://dctd.cancer.gov/about/news-events/news/2026-news/ctcae-updated-version-6 (accessed June 10, 2026).
18. Herrstedt J, Clark-Snow R, Ruhlmann CH, et al. 2023 MASCC and ESMO guideline update for the prevention of chemotherapy- and radiotherapy-induced nausea and vomiting. ESMO Open. 2024; 9: 102195.
19. Sandherr M, Stemler J, Schalk E, et al. 2024 update of the AGIHO guideline on diagnosis and empirical treatment of fever of unknown origin in adult neutropenic patients with solid tumours and hematological malignancies. Lancet Reg Health Eur. 2025; 51: 101214.
20. Li J, Wu Y, Chen C, et al. A systematic review for prevention of cisplatin-induced nephrotoxicity using different hydration protocols and meta-analysis for magnesium hydrate supplementation. Clin Exp Nephrol. 2024; 28: 1–12.
21. Necchi A, Miceli R, Oualla K, et al. Effect of bleomycin administration on the development of pulmonary toxicity in patients with metastatic germ cell tumors receiving first-line chemotherapy: a meta-analysis of randomized studies. Clin Genitourin Cancer. 2017; 15: 213–220.e5.
22. Johnson K, Stoffel B, Schwitter M, et al. Prevention of taxane chemotherapy-induced nail changes and peripheral neuropathy by application of extremity cooling: a prospective single-centre study with intrapatient comparison. Support Care Cancer. 2024; 32: 554.
23. Coolbrandt A, Vancoille K, Dejaeger E, et al. Preventing taxane-related peripheral neuropathy, pain and nail toxicity: a prospective self-controlled trial comparing hilotherapy with frozen gloves in early breast cancer. Breast Cancer Res Treat. 2022; 192: 293–301.
24. Dale W, Klepin HD, Williams GR, et al. Practical assessment and management of vulnerabilities in older patients receiving systemic cancer therapy: ASCO guideline update. J Clin Oncol. 2023; 41: 4293–312.
25. Krens SD, Lassche G, Jansman FGA, et al. Dose recommendations for anticancer drugs in patients with renal or hepatic impairment. Lancet Oncol. 2019; 20: e200–7.
26. Lustberg MB, Kuderer NM, Desai A, et al. Mitigating long-term and delayed adverse events associated with cancer treatment: implications for survivorship. Nat Rev Clin Oncol. 2023; 20: 527–42.
27. Maggiore U, Palmisano A, Buti S, et al. Chemotherapy, targeted therapy and immunotherapy: which drugs can be safely used in solid organ transplant recipients? Transpl Int. 2021; 34: 2442–58.