Rom J Rheumatol 2024, 65(4):134-139 ISSN (print) 1843–0791, ISSN (online) 2069–6086

Revista Română de Reumatologie
Romanian Journal of Rheumatology

CASE REPORT

Immune Checkpoint Inhibitors in Metastatic Melanoma – Is This too High of a Price?

LIANA CHICEA[1)], NICOLETA BURIC [2)]

[1)]*Rheumatology Department, Academic Emergency Hospital Sibiu*
[2)]*University Lucian Blaga Sibiu, Romania*

Abstract

Background and aims. Nivolumab is highly effective, as monotherapy or in combinations (with Ipilimumab), for treatment of patients with unresectable or metastatic melanoma and many other cancers. Autoimmune side effects include systemic and organ-specific disease, from mild to life-threatening severity. Their impact on the treatment response may be important.

Methods. We present two advanced melanoma cases, male, 72 and 62 years old. Despite initial tolerability of Nivolumab /Ipilimumab and good response on disease progression, both developed severe autoimmune musculoskeletal side effects.

Case 1. Metastatic melanoma. The tumor size dramatically decreased during nivolumab treatment and over the following 15 weeks. Adverse events were diagnosed by rheumatologists: monoarthritis, severe erythroderma that promptly responded to high-dose glucocorticoids (GC) but rebounded after GC tapering, late onset, non-reversible, rapidly progressive renal failure with haemodialysis and autoimmune progressive pneumonitis with respiratory failure and death.

Case 2. Melanoma stage IV, treated with Nivolumab and Ipilimumab with good response during 6 months, presenting with progressive pain and proximal muscle weakness after discontinuation, had good initial response to GC. Inflammatory immune myopathy, polymyalgia rheumatica and sensitive neuropathy were diagnosed and efficiently controlled with GC treatment and successful oncologic course.

Conclusions. Development of autoimmune disease during checkpoint inhibitor treatment for neoplastic diseases may correlate with efficacy and furthermore impact survival. Rheumatologists may be helpful in checkpoint inhibitors autoimmune side-effects management. Careful and prolonged follow-up, developing protocols and increase patient awareness are essential to improve outcomes. High-dose and long-term GCs may increase mortality.

Keywords: checkpoint inhibitors, autoimmune adverse effects, metastatic melanoma.

Introduction

A major milestone in cancer treatment was set in 2011, when ipilimumab was approved for treatment of patients with advanced metastatic melanoma (MM). The unprecedented rates of long-lasting disease control were achieved by the newly discovered antibodies toward immune checkpoints of pre-existent antitumor T cells. Tumor cells may block these specific regulators of immune activation and escape the immune mechanisms, allowing them to malignant proliferation and metastasis. Antibodies blocking checkpoints, known as immune checkpoint inhibitors (ICPs) such as the cytotoxic T lymphocyte antigen-4 (CTLA-4) or the programmed death-1 (PD-1) pathway are able to activate the immune anti-tumoral response. Several other checkpoint molecules were later introduced as new targets in cancer treatment.

The ICPs proved efficacious for many cancers either in single therapy or in combinations that are able to overcome several resistance mechanisms and are now approved in many countries for an increased number of cancers. However, due to their immune mechanism of action, the use of ICPs induces frequently local or systemic autoimmune side effects in some patients [10, 20, 21]. Since these side effects are almost parallel with a high anti-tumor response and long-term disease control (higher the rates of adverse effects better the clinical improvement), the management of ICPs autoimmune side effects is paramount in order to prolong use and thus oncologic efficacy [1, 7, 9, 23, 30].

For the rheumatologists, this new paradigm in oncologic treatment introduced a new frequent etiology of autoimmune disease and thus a new research field on how to diagnose and treat with remissive/immunosuppressant options [4, 12, 22, 34, 35].

Treatment of metastatic cancer patients under ICPs with autoimmune disease side effects is challenging in diagnosis, treatment and follow-up for oncologists, rheumatologists and patients as well. Rheumatologist's involvement in immune-related adverse events (irAEs) management may increase the

likelihood of a better outcome for the patient [6, 24]. Adherence to treatment and interdisciplinary collaborations are mainstays for a successful management of this complex therapy [17].

Nivolumab (NIV), a PD-1 blocker, and Ipilimumab (IPI), a CTLA-4 inhibitor are highly effective in the treatment of patients with unresectable or metastatic melanoma (MM). Recently published results of the CheckMate 067 study showed a continued, ongoing survival benefit with nivolumab plus ipilimumab and with nivolumab monotherapy, as compared with ipilimumab monotherapy and outstanding results in 10-year melanoma-specific survival: 96% with nivolumab plus ipilimumab, 97% with nivolumab, and 88% with ipilimumab [9].

Here we summarize two recent ICP treated metastatic melanoma cases, highlighting both similarities (in diagnosis and treatment) but also differences (in the stage of the disease, the approach, autoimmune side effects and treatment outcomes). Despite initial ICP tolerability and good response on MM disease progression, both patients developed severe autoimmune musculoskeletal side effects with different course and outcome. We also discussed the role of accurate diagnosis and early treatment in malignant disease, the differential diagnosis difficulties in the rheumatic medicine-related disease and other factors that may impact prognosis.

Clinical Case 1

A 62 years old male, heavy smoker, was admitted in June 2019 for the first time in the Rheumatology department with acute monoarthritis (right swollen ankle) associated with severe erythrodermia (4th grade). Clinical medical history significant for a MM diagnosis began 15 years ago (on left pectoral skin), and he underwent surgery and two chemotherapy courses with long time disease remission. After 9 years in remission, he developed metastatic MM (histopathology) with subsequent surgeries for terminal ileum (2013), retropancreatic adenopathy (2014) and compressive retrogastric mass (February 2019). ICPs (NIV) were first started in March 2019 with 3 courses of NIV until May, resulting in a dramatic decrease of the residual unresectable tumor size and compressive effects, which lasted for over the following 15 weeks as per computed tomography (CT). Figure 1.

At his first presentation to rheumatology, other common causes of acute monoarthritis were ruled out and he had good arthritis response to high dose glucocorticoid (GC) treatment. When GC was tapered, erythrodermia rebounded and NIV was discontinued. Local and general treatment for skin disease and secondary bacterial and fungal infections were also addressed.

The last NIV infusion (end of May) was followed in the next month by progressive autoimmune pneumonitis, restrictive respiratory disfunction and severe fatigue with prolonged bed rest. Partial response to a new dose increase for a GC course was noted, but in the next 6 weeks he developed renal involvement and severe Klebsiella pneumoniae infection, leading to respiratory failure and death. Progressive renal failure remained of an unclear cause, but diagnosis work-up ruled out all infectious, degenerative, immune, inflammatory and metastatic causes of vascular, tubulo-interstitial, glomerular diseases. Finally, a diagnosis of non-reversible late onset tubulo-interstitial immune nephropathy was determined. As no response was noted despite pulse-therapy and high dose GC, hemodialysis was initiated and continued until the patient deceased (end September 2019) due to pulmonary origin sepsis.

Case report 2

A 72 years old male was admitted in September 2021 in the Rheumatology department for newly onset proximal myalgias at the scapulo-humeral and pelvic girdle. Six month previously (March 2021), he was diagnosed with TxN3cM1a-stage IV melanoma BRAF V600E mutant. Diagnosis was based on a posterior thorax painful 60/35mm tumoral lesion and left swollen axillar lymph node pathology (histopathologic exam), concomitant with metastatic rib osteolysis. Induction regimen chemotherapy with NIV (3mg/kc) and IPI (1 mg/kc) was initiated, followed by maintenance regimen with NIV monotherapy for six month (March-September 2021). As a mild side effect, the patient experienced grade 1 cutaneous toxicity with no impact on the recently started ICP therapy. He also had good response to a short course of GC given by his Oncologist for an autoimmune gastritis (grade III) that occurred after the third month of ICPs therapy. Importantly, the therapy was afterwards continued but at a decreased dose.

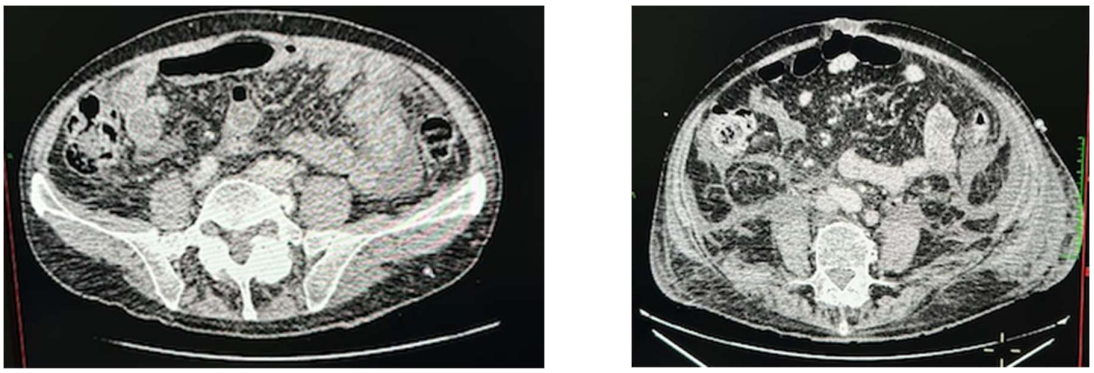
In our Rheumatology department, patient was diagnosed with inflammatory immune myopathy and polymyalgia rheumatica, with suggestive clinical findings (upper limbs predominantly progressive proximal myopathy, severe sensitive peripheral diffuse neuropathy), lab values (no systemic inflammatory syndrome, no muscular specific enzymes or antibodies), electroneurological and electromyographic studies and ultrasonography shoulder findings (asymmetrical bilateral bursitis and bicipital tenosynovitis).

ICPs were discontinued and GC high dose treatment initiated and rapidly tapered to a low maintenance dose after unsuccessful withdrawal attempts. Methotrexate was added also as a GC sparing agent, at a moderate dose and continued (follow-up visit until October 2024), with good response on both rheumatic and oncologic diseases and no CT/MRI progression of MM after 2 year ICPs discontinuation. Figure 2.

Table 1. Summary of the clinical cases.

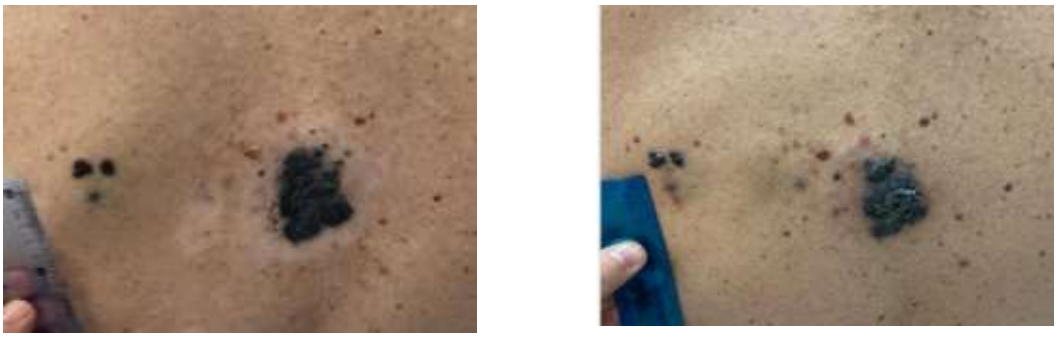
	CASE 1	CASE 2

Gender, age	Male, 62yo,	Male, 72yo,
Oncologic disease	15 years MM, metastatic	6 month MM, metastatic
ICPs treatment, duration	NIV, 3 month	NIV+IPI, NIV, 6 month
Autoimmune adverse effects (AEs)	arthritis, autoimmune pneumonitis (remission) late onset progressive tubulo-interstitial immune nephropathy and irreversible kidney failure	inflammatory immune myopathy polymyalgia rheumatic autoimmune gastritis
Treatment for immune AEs	GC – 4 month	GC, MTX – 2 years
Outcome/end of follow-up	Good tumor response Arthritis, pneumonitis – responsive to GC Hemodialysis -for renal autoimmune irresponsive disease Sepsis (under GC) Death	Good sustained tumor response, Good control of autoimmune AEs (asymptomatic) No subsequent serious AEs



(a) **(b)**

Figure 1. Case 1: Abdominal CT showing metastatic tumor response after NIV: Jul (left) and Sept (right).



(a) **(b)**

Figure 2. Case 2: Cutaneous response after NIV+IPI.

Discussions

There is large emerging data on ICPs molecules, their mechanism of action and increasing efficacy in different types/stages of cancer. Accumulating experience in ICPs use is raising concern on ICP's safety, mostly on triggered organ-specific or systemic autoimmunity and adverse effects from mild to life-threatening severity [5, 10, 32]. Incidence of mild-moderate (grade 1 and 2) immune-related adverse events (irAEs) was reported to be around 25%, while more serious irAEs incidence was lower (5,8% from total). Skin toxicity (14.2%) that usually heralds more severe irAEs, followed by gastrointestinal toxicity (6.7%) had the highest incidence rate in most cohorts. Patients with cancer stage IV and poor performance status have higher odds of experiencing irAEs. ICPs adverse effects may have an important impact on the treatment response and are currently managed by oncologists in most countries, based on specific recommendations [1,8,11].

There is no consensus on the risk factors for either developing ICPs immune related adverse events or changing oncologic disease course. As in our cases, patient 2 had more risk factors for AEs (older age, induction combined therapy with NIV+IPI), but also better outcome compared to patient 1 [18, 19]. Some recent studies tried to develop a predictive model for irAEs in patients with cancer treated with ICPs [25]. It is also possible that accurate markers will emerge from artificial intelligence on ICPs for identifying cancer patients at risk for irAEs and personalized/precision medicine decision making for best treatment. Some newly published data focused on irAEs correlation with the tumor type in terms of the affected organs,

incidence, median onset time, and severity, may also impact the future therapeutic ICPs efficacy and safety [12, 29].

In a recent real-world analysis of delayed (later than three months after ICPs initiation) irAEs, on a very large database, males and anti PD-1 treatment had a higher reporting frequency for respiratory disorders, mostly pneumonitis [31]. Furthermore, in a recent global pharmacovigilance study, the largest case series of late-onset irAEs with ICPs to date, showed that combination of ICPs, male cases with a median age of 67 years, and thyroiditis, pneumonitis, interstitial lung disease were more frequently reported. Importantly, the median time to onset to ICP discontinuation was 167 days in this study [15].

Acute kidney injury (AKI) is the most common nephrotoxicity, usually related to acute interstitial ICPs-nephritis, especially by anti PD-1 agents [13]. It has been suggested that AKI could have a genetic predisposition in Caucasians. Using large-scale real-world data, a specific variant in the PCCA gene was a significant risk genotype for ICP-AKI, that developed significantly earlier than in patients with the reference genotype. In the same study, one-year AKI incidence rate was three times higher in the ICPs cohort versus the general cohort (23.2 % versus 6.5 %) [28].

Pulmonary status of cancer patients previous to chemotherapy with or without ICP may also induce a higher risk for respiratory serious adverse events. Smoking and interstitial lung abnormalities are associated with an increased risk of developing drug-related pneumonitis in cancer patients treated [16].

Differential diagnosis of immune related adverse events may be challenging; the same conditions/entities may be paraneoplastic manifestations, undiagnosed pre-existing rheumatological conditions (less common) or neoplasia progression signs. It is well recognised that ICP induced autoimmune disease may be a good prognostic marker for the good tumoral response, as illustrated also by our second case report [14].

Polymyalgia rheumatica is associated with cancer, either as a paraneoplastic syndrome or as irAEs frequently induced by ICPs. Atypical patients are diagnosed as polymyalgia rheumatic-like syndrome. Although diagnostic criteria are clearly specified, glucocorticoid dose treatment for ICP induced disease is still debated and needs to be adjusted on an individual base, with close clinical follow-up [2, 11, 26].

Fatal adverse events due to ICPs use are still rare. Toxicity-related fatality rates of 0,36% to 1,23% were found in a meta-analysis using data from several large academic medical centers, global pharmacovigilance data, and all published ICP clinical trials of patients with cancer treated prior to 2018 with anti- PD-1/PD-L1 and anti- CTLA-4 internationally. Usually, fatal toxic effects typically occurred early after therapy initiation. Although pneumonitis is more frequent, nephritis seems to be more dangerous, with a higher fatality rate among all ICPs toxicities [27].

Relatively few studies have assessed associations of concomitant medications with the occurrence and profile of immune-related adverse events (14). A large cohort of all-cause cancer patients found a negative association between the occurrence of irAEs and concomitant medication, including antibiotics, proton pump inhibitors and corticosteroids. This may also apply to our first patient who had a higher drug score related to more severe irAEs developed compared to 2nd patient.

Immunosuppression may be necessary to control severe life–threatening autoimmune side effects. It was cautiously used in cancer treated patients in order not to compromise the tumour response, so scarce data are available on this issue. High dose glucocorticoids (GC) are mostly used to control autoimmune side effects, but these may go with increased mortality, mainly due to severe infection, as occurred in our first case. However, over the last few years, all recommendations released by international authorities emphasize the urge to reduce the use of GC for any autoimmune disease treatment. As corticoid-sparing agents, conventional disease modifying antirheumatic drugs (DMARDs) such as MTX proved to be beneficial and do not seem to decrease ICP efficacy [35]. There is a large amount of recent data on simultaneously safe use of ICPs and DMARDs, providing solid reason for old and newer recommendations of life-saving ICPs despite their generally manageable autoimmune side effects. Moreover, some biologic DMARDs familiar in the rheumatologists' armamentarium, e.g. TNF alpha inhibitors and Tocilizumab, were also used in such patients with good efficacy for both rheumatologic and oncologic disease control and importantly also enhanced tumour response to ICPs [3, 20].

Our experience is in agreement with a large body of evidence that shows how rheumatologists' involvement in irAEs management may increase the likelihood of a better outcomes for patients [6]. A multi-disciplinary team (oncologist, rheumatologist, internal medicine specialist / hospitalist, nephrologist, dermatologist, endocrinologist, intensive care and infectious disease specialist) should diagnose and treat complex manifestations of irAEs, which require important medical decisions such as ICPs dis-/continuation or immunosuppressive treatment of irAEs.

Conclusions

In conclusion, nivolumab monotherapy or combined with ipilimumab is highly effective in the treatment of patients with unresectable or metastatic melanoma, with recent data on unprecedented patient survival rates at 10 years. Autoimmune disease during life-saving ICPs treatment for MM may correlate with efficacy and furthermore impact survival. Immune related adverse events such as arthralgia/arthritis, polymyalgia rheumatic –like syndrome, are mostly expected in the first three month of ICPs treatment and are generally mild or moderate. More severe adverse events, such as gastritis, pneumonitis, nephritis,

adrenal insufficiency and hypophysitis need early diagnosis and treatment. Importantly, they can be controlled with synthetic or biologic DMARDs. High-dose and long-term GC treatment is required in most patients to control these severe life – threatening side effects, but high doses GC are also associated with increased mortality. Rheumatologists involvement in irAEs management may increase the likelihood of a better outcome for the patients, but adherence and interdisciplinary efforts are the mainstay for successful management.

Conflicts of Interest: The authors declare no conflicts of interest.

References

[1] Brahmer JR, Abu-Sbeih H, Ascierto PA, Brufsky J, Cappelli LC, Cortazar FB, Gerber DE, Hamad L, Hansen E, Johnson DB, Lacouture ME, Masters GA, Naidoo J, Nanni M, Perales MA, Puzanov I, Santomasso BD, Shanbhag SP, Sharma R, Skondra D, Sosman JA, Turner M, Ernstoff MS. Society for Immunotherapy of Cancer (SITC) clinical practice guideline on immune checkpoint inhibitor-related adverse events. J Immunother Cancer. 2021.

[2] Calabrese C, Cappelli LC, Kostine M, Kirchner E, Braaten T, Calabrese L. Polymyalgia rheumatica-like syndrome from checkpoint inhibitor therapy: case series and systematic review of the literature. RMD Open. 2019.

[3] Chen Y, Luo Y, Liu Y, Luo D, Liu A. Dual efficacy of tocilizumab in managing PD-1 inhibitors-induced myocardial inflammatory injury and suppressing tumor growth with PD-1 inhibitors: a preclinical study. Cancer Immunol Immunother. 2025.

[4] Dang QM, Watanabe R, Shiomi M, Fukumoto K, Nobashi TW, Okano T, Yamada S, Hashimoto M. Rheumatic Immune-Related Adverse Events due to Immune Checkpoint Inhibitors. A 2023 Update. Int J Mol Sci. 2023

[5] Darnell, E. P., Mooradian, M. J., Baruch, E. N., Yilmaz, M. & Reynolds, K. L. Immune-related adverse events (irAEs): diagnosis, management, and clinical pearls. Curr. Oncol. 2020.

[6] Gagliano C, Foti R, Visalli E, Dammino E, Maniaci A, Foti R, Incognito D, Foti R, Zeppieri M. Uncommon but Significant: Onset, Characteristics and Management of Vasculitis and Connective Tissue Diseases Induced by Immunomodulators during Cancer Treatment. Discov Med. 2024

[7] Haanen J, Obeid M, Spain L, Carbonnel F, Wang Y, Robert C, et al. Management of toxicities from immunotherapy: ESMO clinical practice guideline for diagnosis, treatment and follow-up. Ann Oncol. 2022.

[8] Herrmann SM, Abudayyeh A, Gupta S, Gudsoorkar P, Klomjit N, Motwani SS, Karam S, Costa E Silva VT, Khalid SB, Anand S, Kala J, Leaf DE, Murakami N, Rashidi A, Wanchoo R, Kitchlu A. Diagnosis and management of immune checkpoint inhibitor-associated nephrotoxicity: a position statement from the American Society of Onco-nephrology. Kidney Int. 2025.

[9] Jedd D. Wolchok, Vanna Chiarion-Sileni, Piotr Rutkowski, C. Lance Cowey, Dirk Schadendorf, John Wagstaff, Paola Queirolo. Final, 10-Year Outcomes with Nivolumab plus Ipilimumab in Advanced Melanoma. N Engl J Med. 2025.

[10] Khan S, Gerber DE. Autoimmunity, checkpoint inhibitor therapy and immune-related adverse events: A review. Semin Cancer Biol. 2020.

[11] Kostine M, Finckh A, Bingham CO, et al. EULAR points to consider for the diagnosis and management of rheumatic immune-related adverse events due to cancer immunotherapy with checkpoint inhibitors. Ann Rheum Dis. 2021.

[12] Lereim RR, Dunn C, Aamdal E, Chauhan SK, Straume O, Guren TK, Kyte JA. Plasma protein dynamics during ipilimumab treatment in metastatic melanoma: associations with tumor response, adverse events and survival. Oncoimmunology. 2025

[13] Miao J, Sise ME, Herrmann SM. Immune checkpoint inhibitor related nephrotoxicity: Advances in clinicopathologic features, noninvasive approaches, and therapeutic strategy and rechallenge. Front Nephrol. 2022

[14] Nara K, Taguchi S, Buti S, Kawai T, Uemura Y, Yamamoto T, Kume H, Takada T. Associations of concomitant medications with immune-related adverse events and survival in advanced cancers treated with immune checkpoint inhibitors: a comprehensive pan-cancer analysis. J Immunother Cancer. 2024.

[15] Noseda R, Bedussi F, Giunchi V, Fusaroli M, Raschi E, Ceschi A. Reporting of late-onset immune-related adverse events with immune checkpoint inhibitors in VigiBase. J Immunother Cancer. 2024

[16] Oishi K, Hozumi H, Yoshizawa N, Ichikawa S, Inoue Y, Yasui H, Suzuki Y, Karayama M, Furuhashi K, Enomoto N, Fujisawa T, Goshima S, Inui N, Suda T. Association of interstitial lung abnormalities with cytotoxic agent-induced pneumonitis in patients with malignancy. Respir Med. 2024.

[17] Pacholczak-Madej R, Immune Checkpoint Inhibitor Related Rheumatological Complications: Cooperation between Rheumatologists and Oncologists. Int J Environ Res Public Health. 2023.

[18] Poletto S. et al. Predictive Factors in Metastatic Melanoma Treated with Immune Checkpoint Inhibitors: From Clinical Practice to Future Perspective. Cancers 2023.

[19] Poletto, S.; Paruzzo, L.; Nepote, A.; Caravelli, D.; Sangiolo, D.; Carnevale-Schianca, F. Predictive Factors in Metastatic Melanoma Treated with Immune Checkpoint Inhibitors: From Clinical Practice to Future Perspective. Cancers, 2024.

[20] Reschke R, Sullivan RJ, Lipson EJ, Enk AH, Gajewski TF, Hassel JC. Targeting molecular pathways to control immune checkpoint inhibitor toxicities. Trends Immunol. 2024.

[21] Ramos-Casals M, Brahmer JR, Callahan MK, Flores-Chávez A, Keegan N, Khamashta MA, Lambotte O, Mariette X, Prat A, Suárez-Almazor ME. Immune-related adverse events of checkpoint inhibitors. Nat Rev Dis Primers. 2020.

[22] Roberts J, Barmettler S, Murray J, Melvin JE, Ye C. Musculoskeletal immune-related adverse events of PD-(L)1 inhibitors in melanoma: a systematic review and meta-analysis. Immunotherapy. 2024.

[23] Schneider BJ, Naidoo J, Santomasso BD, Lacchetti C, Adkins S, Anadkat M, et al. Management of immune-related adverse events in patients treated with immune checkpoint inhibitor therapy: ASCO guideline update. J Clin Oncol. 2021.

[24] Takeda K, Shiga T. The knowledge and skills required for the onco-rheumatologist: Study of four-year consultation records of a high-volume cancer centre. Mod Rheumatol. 2024.

[25] Tang Y, Shi J, Wang L, Zhang Y, Xu L, Sun T. Development of a predictive model for immune related adverse events in patients with cancer. Oncol Lett. 2024.

[26] Tsurui T, Ariizumi H, Kubota Y, Tsunoda T. Severe Polymyalgia Rheumatica-Like Syndrome Induced by Immune Checkpoint Inhibitor: A Case Report and Literature Review. Cureus. 2024

[27] Wang DY, Salem JE, Cohen JV, Chandra S, Menzer C, Ye F, Zhao S, Das S, Beckermann KE, Ha L, Rathmell WK, Ancell KK, Balko JM, Bowman C, Davis EJ, Chism DD, Horn L, Long GV, Carlino MS, Lebrun-Vignes B, Eroglu Z, Hassel JC, Menzies AM, Sosman JA, Sullivan RJ, Moslehi JJ, Johnson DB. Fatal Toxic Effects Associated With Immune Checkpoint Inhibitors: A Systematic Review and Meta-analysis. JAMA Oncol. 2018.

[28] Wang Y, Xiong C, Yu W, Zhou M, Shugg T, Hsu FC, Eadon MT, Su J, Song Q. PCCA variant rs16957301 is a novel AKI risk genotype-specific for patients who receive ICI treatment: Real-world evidence from all of us cohort. Eur J Cancer. 2024.
[29] Xu Q, Hu J, Wang Y, Wang Z. The role of tumor types in immune-related adverse events. Clin Transl Oncol. 2024. Epub ahead of print
[30] Yamaguchi A, Saito Y, Okamoto K, Furugen A, Narumi K, Takekuma Y, Sakakibara-Konishi J, Shimizu Y, Kinoshita I, Sugawara M, Kobayashi M. Association Between Multisystem Immune-related Adverse Events and Progression-free Survivals in PD-1/PD-L1 Inhibitor Monotherapy. In Vivo. 2024.
[31] Yang Y, Li L, Tian J, Ma L, Wu Y, Luo Q, Luo Y. Delayed immune-related adverse events profile associated with immune checkpoint inhibitors: a real-world analysis. Front Pharmacol. 2024.
[32] Zhang Q, Chen J, Tsai N, Zhu X, Zhao M, Meng L, Fong P. Characterising immune-related adverse events in different types of cancer among Chinese patients receiving immune checkpoint inhibitors. Sci Rep. 2024.
[33] Zhao M et al. Advances of autoimmune rheumatic diseases related to malignant tumors. Inflamm Res. 2023.
[34] Zhong H, Zhou J, Xu D, Zeng X. Rheumatic immune-related adverse events induced by immune checkpoint inhibitors. Asia Pac J Clin Oncol. 2021.
[35] Zhou J, Wang H, Guo X, Wang Q, Duan L, Si X, Zhang L, Liu X, Li Y, Zhang W, Zhang L. Management of immune checkpoint inhibitor-related rheumatic adverse events. Thorac Cancer. 2020.

Corresponding author

Liana Chicea, Rheumatology Department, Academic Emergency Hospital Sibiu, Romania; email: liana.chicea@gmail com.

Received: 30.11.2024

Accepted: 21.12.2024