ORIGINAL ARTICLE

A decade of Non-Small Cell Lung Cancer management: threats and opportunities in resource-limited setting

Une décennie de prise en charge du cancer du poumon non à petites cellules : menaces et opportunités en contexte de ressources limitées

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Abstract

Introduction: Non-small cell lung cancer (NSCLC) poses significant public health challenges in Tunisia.This study analyzes patient characteristics, management, and outcomes to identify improvement areas.

Methods: This retrospective multicenter study included 924 patients diagnosed with NSCLC between 2013 and 2022. The study reviewed clinical data, pathology reports, surgical records, radiation therapy summaries, and imaging findings. The study also examined trends in management features by dividing the study period into 2012-2017 vs 2018-2022.

Results: Median age was 60 years, with 78.7% being male, and the average tobacco consumption was 58 pack-years. Advanced-stage disease was highly prevalent, with 91% of patients presenting at stages III or IV. The median overall survival for the entire population was 32 months, varying significantly by disease stage: 52 months for stage I, 48 months for stage II, 22 months for stage III, and 14 months for stage IV. In advanced NSCLC, survival was notably higher among patients treated with targeted therapy (44 months) and immunotherapy (20 months) compared to chemotherapy alone (9 months). Over time, there was a significant increase in multidisciplinary discussions and biomarker testing rates; however, access to concurrent chemoradiation decreased. Despite some improvement, access to targeted therapy and immunotherapy remained limited. Among tested patients, a driver mutation was identified in 45.5%, but only 54% received targeted therapy. Furthermore, only 9.8% of advanced-stage patients received immunotherapy.

Conclusion: This study serves as a baseline for future studies and highlights critical gaps in NSCLC care in Tunisia, emphasizing the need for strategic directions to enhance outcomes.

Keywords: non-small cell lung cancer, survival, management, gaps

Résumé

Introduction : Cette étude a analysé les menaces autours de leur prise en charge ainsi que les axes d'amélioration.

Méthodes : Cette étude rétrospective multicentrique a inclus 924 patients diagnostiqués avec un CPNPC entre 2013-2022. Les données cliniques, les comptes rendus anatomopathologiques, les rapports chirurgicaux/de radiothérapie et les examens d'imagerie ont été analysés. L'étude a également examiné l'évolution des modalités de prise en charge en comparant les périodes 2013–2017 et 2018–2022.

Résultats : L'âge médian était de 60 ans, avec une prédominance masculine (78,7 %) et un tanagisme à 58 paquets-années. La maladie était dans 91 % de stade III ou IV. La survie globale médiane de l'ensemble de la population était de 32 mois, avec des variations selon le stade : 52 mois pour le stade I, 48 mois pour le stade II, 22 mois pour le stade III et 14 mois pour le stade IV. En cas de CPNPC avancé, la survie était significativement plus longue chez les patients traités par thérapies ciblées (44 mois) ou immunothérapie (20 mois) comparé à la chimiothérapie seule (9 mois). Au fil du temps, une augmentation significative des discussions multidisciplinaires et du recours aux tests de biomarqueurs a été observée ; toutefois, l'accès à la chimioradiothérapie concomitante a diminué. Parmi les patients testés, une mutation cible a été identifiée dans 45,5 % des cas, mais seulement 54 % ont bénéficié d'une thérapie ciblée. Par ailleurs, seuls 9,8 % des patients à un stade avancé ont reçu une immunothérapie.

Conclusion : Cette étude a mis en lumière des lacunes critiques dans la prise en charge du CPNPC en Tunisie, soulignant la nécessité de stratégies ciblées pour améliorer les résultats.

Mots-clés : cancer du poumon non à petites cellules, survie, prise en charge, lacunes

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This study represents the largest real-world analysis of non-small cell lung cancer (NSCLC) in Tunisia, based on a retrospective cohort of 1000 patients over the past decade. It provides unprecedented insight into the epidemiological, clinical, and therapeutic landscape of NSCLC in a resource-limited setting. The findings reveal major disparities in access to innovative treatments, the high prevalence of late-stage diagnoses, and the relevance of familial cancer history. By addressing a significant data gap in regional oncology, this work lays the foundation for future prospective research and informs national cancer control strategies. To date, no comparable dataset has been published from North Africa, underscoring the novelty and broader relevance of this study

Introduction

Non-small cell lung cancer (NSCLC) remains one of the leading causes of cancer-related mortality worldwide [1], with a significant and increasing burden in low- and middle-income countries. Tunisia, like many North African nations, faces unique epidemiological, social, and healthcare challenges in addressing this public health issue. The incidence of lung cancer in Tunisia has shown a notable rise in recent years [2], attributed to changing tobacco use patterns, environmental exposures, and aging population dynamics. Despite advancements in diagnostic modalities and therapeutic approaches, outcomes for NSCLC patients remain poor globally, with significant variations in survival and quality of care across regions [3].

Research on non-small cell lung cancer (NSCLC) in Tunisia over the past 15 years has revealed significant epidemiological, clinical, and genetic insights. Various studies have focused on survival rates, histological types, treatment responses, and genetic predispositions among Tunisian patients [4–8]. The largest series published by Misseoui et al., encompassing 1,882 lung cancer cases treated between 1993-2007, reported a median age at diagnosis of 64 years in males and 61 years in females [9]. The predominant histological subtypes were squamous cell carcinoma in males (36.9%) and adenocarcinoma in females (52%). Advanced-stage disease (stage IV) was observed in 79.9% of cases. The findings indicate a concerning trend of late-stage diagnoses and highlight the need for improved management strategies.

This retrospective study presents a more recent series of patients with NSCLC in Tunisia diagnosed between 2013 and 2022, analyzing clinical, pathological, and therapeutic data to describe population characteristics, management strategies, and report the real-world outcome. By examining these variables and gathering/comparing them to previously published results, the study aimed to identify areas for improvement in NSCLC care, ultimately contributing to evidence-based recommendations tailored to the Tunisian context.

Methods

This retrospective study was conducted on patients diagnosed across four pneumology departments from public and private sector institutions then referred to Hospital which is as the national referral center for lung and cardiac diseases. It encompassed seven pulmonology departments, a thoracic surgery department, a cardiovascular surgery department, as well as medical and radiation oncology departments, alongside pathology and imaging units. Patients are referred to this institution from multiple regions across the country. The study involved data collection from clinical records of 924 patients diagnosed with non-small cell lung cancer (NSCLC) between January 2013 and December 2022. Clinical data, pathology reports, surgical records, radiation therapy summaries, and imaging findings were thoroughly reviewed. The study population consisted of patients with a confirmed histopathological diagnosis of NSCLC. Inclusion criteria included detailed clinical, pathological, and therapeutic data in patient records. Patients were excluded if their records were incomplete or if they had a subsequent or previous different malignancy. Clinical characteristics, treatment modalities, and outcomes data were extracted for analysis, using a standardized data extraction form developed for this study. Follow-up data regarding treatment response, disease progression, and overall survival were also documented. Ethical approval was obtained from institutional review boards, ensuring compliance with ethical standards and patient confidentiality. The study was conducted according to the Declaration of Helsinki

Statistical Analysis: Descriptive statistics were used to summarize baseline demographic and clinical characteristics, with frequencies and percentages for categorical variables, and mean or median values with ranges for continuous variables. Survival analysis was performed using the Kaplan-Meier method, with comparisons between groups (e.g., by stage or treatment type) assessed using the log-rank test. A p-value of <0.05 was considered statistically significant.

Results

Population

A total of 924 patients were included in the study, with an average age of 60 years [range: 22-93], 78.7% were male. Patients were mainly referred from the north of Tunisia: 70% from North-East (Bizerte, Grand-Tunis, Cap Bon, Zaghouen), 21.4% from the North-Western region (Beja, Jandouba, Kef), 5.4% from the Center in and 3.2% of cases are from the southern region of the country . Population characteristics are summarized in figure 1.

The average tobacco consumption was 58 pack-years (PA). The most common presenting symptoms were chest pain (22.1%), cough (22%), hemoptysis (15.6%), and dyspnea (14.3%). All patients underwent a CT scan, with 87% also receiving a brain CT scan and 69.2% undergoing bronchoscopy. PET-CT was performed in 8% of cases. The median primary tumor size was 56 mm. Adenocarcinoma was the predominant histological subtype (66%), TTF1 was performed in 35% of adenocarcinoma cases. Tumor

biomarker testing was conducted in only 21% (n = 191) of patients, with 94% of these tests performed between 2019 and 2022. The biomarker testing included EGFR alone (18.1%), ALK alone (38.9%), combined EGFR and ALK testing (30.1%), and panel-based next-generation sequencing (13%). A driver targetable mutation was identified in 45.5% of cases (n=87). Patient had a documented multidisciplinary meeting discussion in 33.4% of cases.

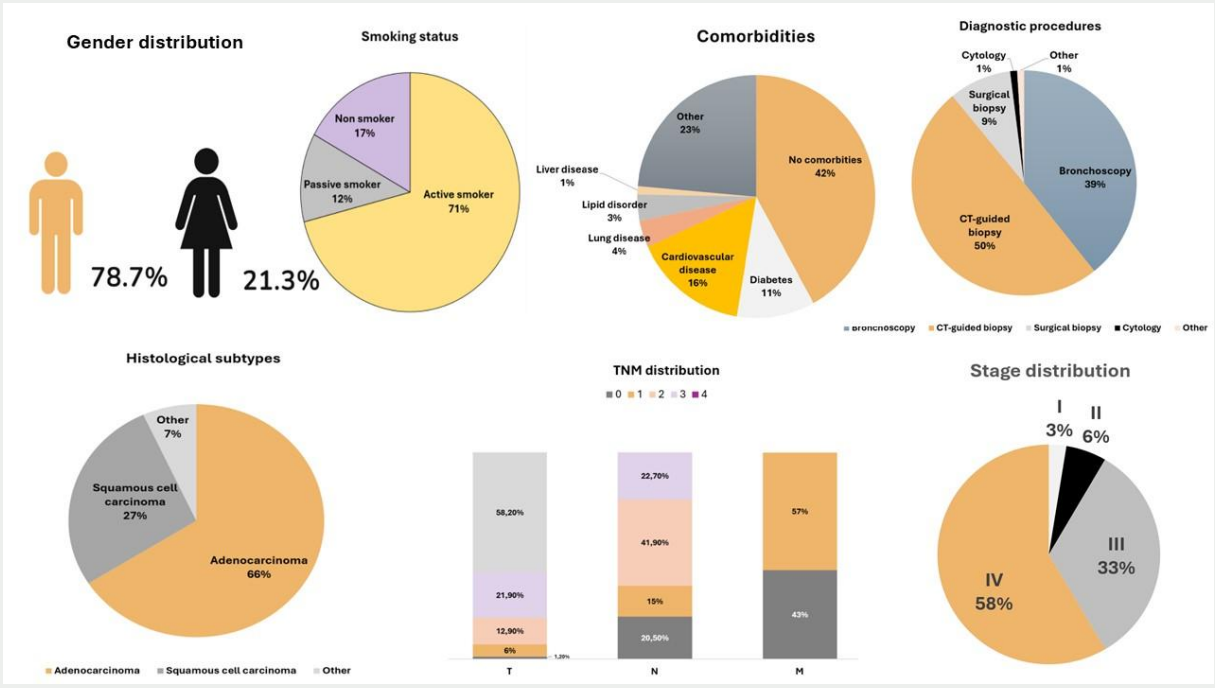

Figure 1. Population characteristics based on Gender Distribution, Comorbidities, Diagnostic procedures, Histological subtypes, TNM and stage distributions

Timelines and trends

Median time between symptoms onset and specialist consultation (pneumologist, oncologists, surgeon…) was 4 months (SD=3.9). The mean time from diagnosis to surgery was 1.18 months (SD 1.90), while the time from surgery to initiation of adjuvant chemotherapy averaged 1.88 months (SD 1.65). For patients receiving neoadjuvant chemotherapy, the mean delay between diagnosis and neoadjuvant chemotherapy initiation was 2.67 months (SD 7.17), and the time from the end of neoadjuvant chemotherapy to surgery was 20 days (SD 12.59). In patients treated with concurrent chemoradiation, the delay between diagnosis initiation of the chemotherapy component of the treatment was 1.19 months (SD 1.61), with a mean duration until the end of chemoradiation averaging 4.94 months (SD 2.92). There was a significant increase in median duration of chemo-radiation between 2012-2017 vs 2018-2022 from 3.4 months to 6.2 months, p=0.01, due to more frequent use of sequential chemoradiation and to delays in radiation therapy appointments. Finally, the average time from diagnosis to the initiation of first-line therapy was 2.01 months (SD 3.12) in patients with stage III NSCLC not amenable to local therapy or de novo stage IV. In order to evaluate the management features trends we divided the study period into 2 periods of 5 years, 2012-2017 vs 2018-2022, and describe the general trends of several parameters as summarized in Figure We observed a significant improvement of multidisciplinary discussion, rate of testing, while access to concurrent chemoradiation decreased. Access to targeted therapy and immunotherapy was low despite the improvement overtime. We did not observe a significant difference in median age (61 vs 60, p=0.46) and intensity of smoking (55 vs 58 PA). There was a significant decrease in tumor size from 64 mm to 49mm, p<0.01. Figure 2

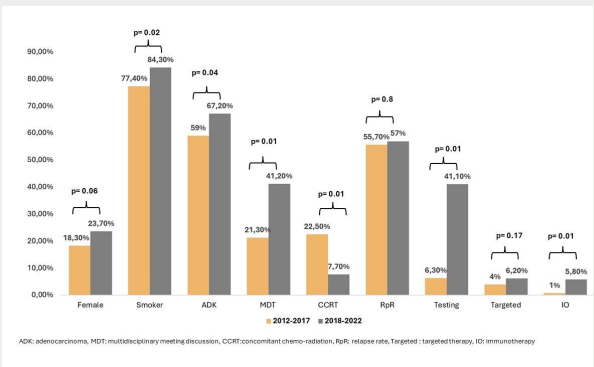

Figure 2. trends over the years

Management and outcome

Of the non-metastatic population, 20% underwent surgical resection (as their only treatment in 2% of cases, followed by adjuvant chemotherapy in 13% and after neoadjuvant chemotherapy in 4% of cases) Adjuvant radiation therapy was given in 6.7% of cases.

Surgical procedures were lobectomy in 79.2%, pneumonectomy in 14.8% and other in 6%. We observed that 10.7% received definitive chemo-radiotherapy, being sequential in 82%. Among patients treated with local therapy (surgery or radiation), relapse rate was 56% (follow up was 31 months). The remaining 69.3% had palliative management.

Therapy administration among patients with stage III NSCLC non amenable to local therapy and De Novo stage IV disease is summarized in figure 3.

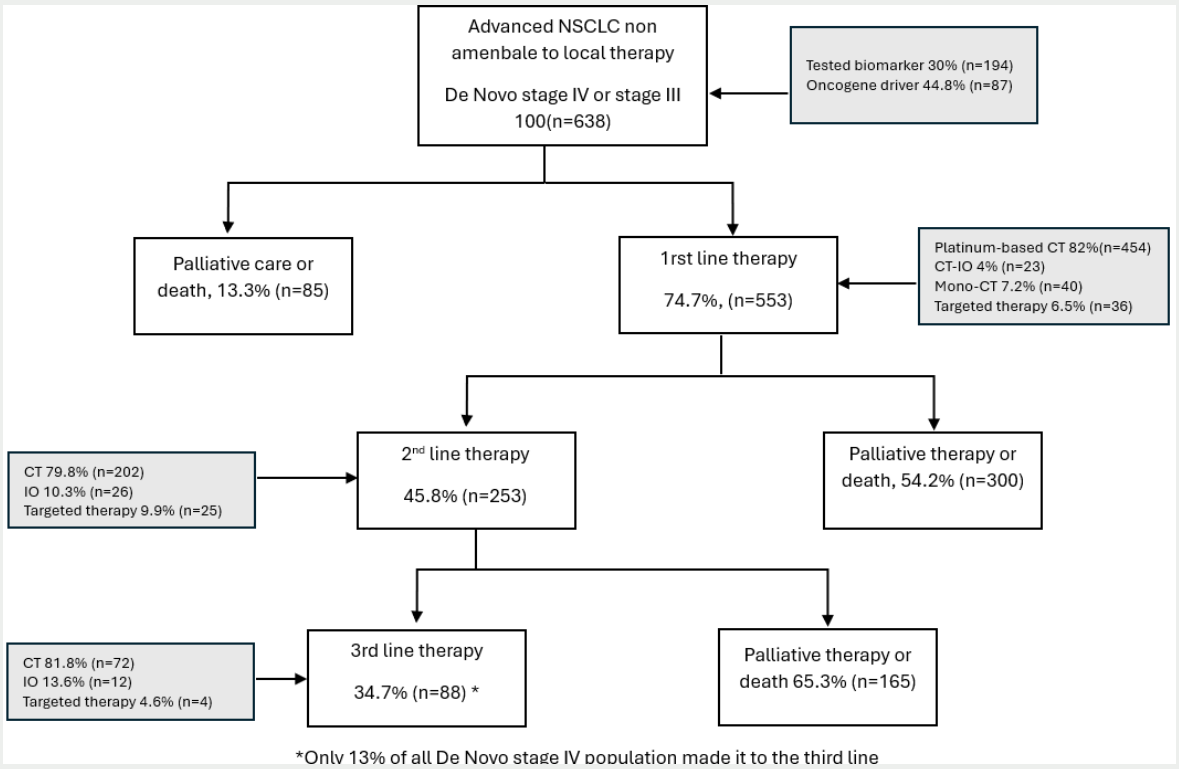

Figure 3. Flowchart of treatment administration in stage III patients non amenable to local therapy and De Novo stage IV NSCLC.

It is of importance to highlight that only 20% of stage III patients could receive local therapy. In patients suggested for sequential chemo-radiation, the delays in radiation therapy appointments lead to the majority progressing and become no longer candidates for radiation therapy.

Patients harboring a driver mutation (n=87), received at least one targeted therapy in 54% (42% first line, 12% in second line, 5% in third line) while them 39% never received targeted therapy and 9% received 2 or more targeted therapy lines sequentially. Only 9.8% of patients with advanced stage could receive immunotherapy at any line of therapy.

Therapeutic outcomes of patients who received palliative treatment are summarized in table1.

After a median follow up of 18 months, the median overall survival (OS) for the entire population was 32 months (95% CI: – months). Survival by disease stage showed a median OS of 52 months for stage I, 48 months for stage II, 22 months for stage III, and 14 months for stage IV (p<0.01). In advanced NSCLC cases, survival was 44 months in patients treated with targeted therapy, 20 months in patients treated with immunotherapy versus 9 months in patients treated with chemotherapy only p<0.01. Figure 4 and 5.

Table 1. Outcomes among different therapeutic groups

	Response rate	Median N° of cycles	p	TTP (months)	p	OS	p
1rst Line Chemotherapy	PD 44% PR 17.6% SD 19.5% CR 0% NK 18.7%	4		6.7	0.01	13	0.01
2nd Line	PD 62.3% PR 12.5% SD 24.2% CR 1% NK 35%	4	0.05	--			
3rd Line	PD 72.3% PR 18.5% SD 9.2% CR 0%	2		--			
Immunotherapy	PD 31% PR 16% SD 47% CR 5%	9		7.9		20	
Targeted therapy	PD 28% SD 8% PR 63% CR 1%	11		11.7		32	

TTP: time to progression, **OS**: overall survival. progressive disease; **PR**: partial remission ; **SD** : stable disease ; **CR** : complete remission ; **NK**: not known

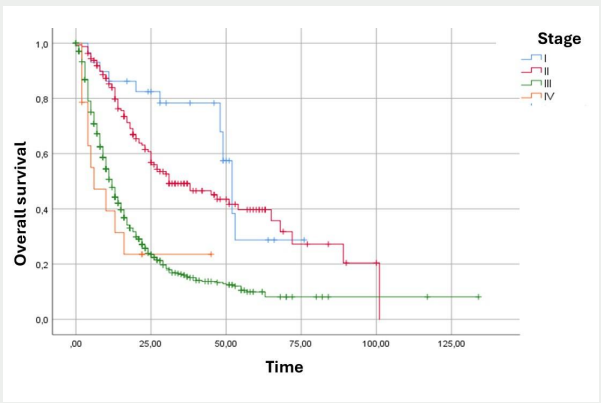

Figure 4. overall survival according to stage

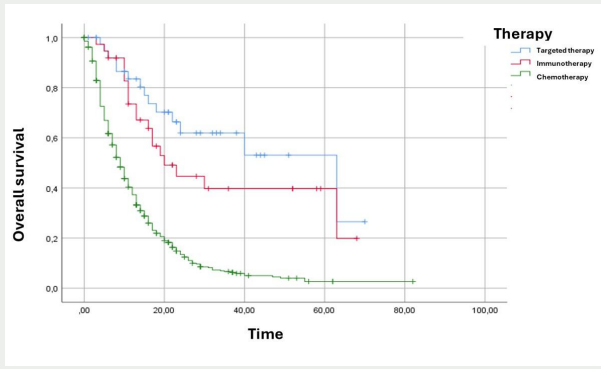

Figure 5. overall survival according to systemic therapy in stage IV and stage III non amenable to local therapy NSCLC

Discussion

Our 10-year retrospective study on non-small cell lung cancer (NSCLC) in Tunisia provides a comprehensive analysis of the disease burden, characterized by a younger patient population, advanced-stage diagnoses, limited access to radiotherapy, targeted therapies, and immunotherapy, as well as high mortality rates, highlighting critical gaps that serve as both areas for improvement and strategic directions for policymakers to enhance outcomes. Indeed, lung cancer represents a heavy burden on the healthcare system, the direct costs of treating lung cancer in Tunisia were estimated to be TND 3900 (US$ 1980) per patient, with chemotherapy accounting for the largest percentage (46%) [10]. Therefore, primary prevention through robust tobacco control measures remains the most effective strategy to reduce morbidity, particularly in light of the substantial smoking burden and its increasing trend compared to earlier studies. Notably, smoking intensity in our population, measured at 58 pack-years, was significantly higher than the 47 pack-years reported by Joobeur et al., underscoring the urgent need for intensified anti-smoking initiatives [8].

The median age of patients with NSCLC in Tunisia has remained stable over two decades, ranging from 59 to 62 years in earlier studies [8,9], aligned with the trend of cancer diagnoses occurring approximately 10 years earlier in Tunisia compared to Western populations. A notable pathological shift toward adenocarcinoma has been observed, consistent with global trends in NSCLC. Advanced stages (III and IV) were predominant, representing 79.9% in Misseoui et al. and 81.4% in Joobeur et al., compared to 91% in our series. Half had comorbidities, adding to the complexity of treatment and management.

Following symptom onset, most patients in our series were able to access a specialist for initial diagnostic and workup procedures, including bronchoscopy, CT-guided biopsy, and imaging. In the series by Chaari et al., histological confirmation was achieved through bronchoscopy in 78% of cases, surgical biopsy in 10%, and CT-guided biopsy in 12% [11]. The observed shift toward more frequent and rapid access to CT-guided biopsy and surgery, reflects both the increasing prevalence of adenocarcinomas—typically peripheral lesions—and improved access to CT scans in Tunisia. Significant progress has been made, with the expansion of pneumology and pathology services as well as the availability of imaging resources such as CT scans.

Despite these advancements, delays between symptom onset and consultation with a specialist persist, contributing to late-stage diagnosis. Addressing this issue requires a multi-faceted approach, including increasing public awareness of lung cancer symptoms, implementing a national lung cancer screening strategy, strengthening the role of primary healthcare providers in early detection and referral, and establishing clear national guidelines to prioritize resource allocation. These guidelines should focus on operable disease and cases eligible for immediate chemoradiation. By improving access to timely care and optimizing the referral process, Tunisia can further enhance outcomes for patients with NSCLC. Timelines from diagnosis to surgery in our series align with international standards [12]; however, the lack of access to PET-CT for precise staging limits the optimal selection of surgical candidates. This, among other factors, contributes to a high recurrence rate exceeding 50%. For this reason, prioritizing access to PET-CT for these patients should be a key focus in improving lung cancer management, particularly for those being considered for surgery.

The low rate of concurrent chemoradiotherapy (CRT) for stage III NSCLC patients in our series, along with its decline between 2012–2017 and 2018–2022, highlights significant challenges in access to radiotherapy. This reduction can be attributed to decreased reimbursement capacities during the last study period, further exacerbating barriers to care. Additionally, the prolonged treatment durations observed, often due to delayed appointments for radiotherapy, underscore the critical gaps in infrastructure and resource availability. The evolution of equipment in radiation oncology over the last decade in Tunisia has significantly improved treatment capabilities. The introduction of advanced technologies, including 3D conformal radiotherapy, intensity-modulated radiotherapy, and stereotactic radiotherapy, was made possible by the installation of new-generation linear accelerators. Currently, there are five public and eight private centers operating with a total of 25 machines. However, the number of radiotherapy machines remains insufficient to meet the increasing demand, as cancer incidence continues to rise. With only one machine available per 500,000 inhabitants, Tunisia falls below the threshold recommended by the IAEA. This shortfall contributes

to limited access to radiotherapy, creating significant barriers for patients requiring timely treatment. One notable consequence of these limitations is the frequent observation of distant metastases at the first evaluation following the completion of treatment for locally advanced disease. The restricted availability of PET scans exacerbates this issue, leading to underdiagnosis of subclinical metastatic stages. PET scans have proven highly effective in detecting occult distant metastases in NSCLC, with up to 24% of stage III cases revealing metastases previously undetected by other means [13]. Additionally, PET scans have demonstrated their accuracy in tumor delineation for NSCLC [14], enabling dose escalation and improved local control, as evidenced in phase II studies [15]. Results from an ongoing phase III trial are highly anticipated. Moderate hypofractionation radiotherapy has emerged as the standard of care for patients with locally advanced, non-operable NSCLC in the UK. This approach shortens treatment duration, allowing more patients to receive necessary care. Recent phase III trial data indicate that hypofractionation can be safely delivered in combination with concurrent chemotherapy for locally advanced NSCLC, providing an effective treatment option in limited resources setting [16]. By addressing these challenges and incorporating more reimbursement, Tunisia can enhance its radiotherapy capabilities and improve outcomes for patients with NSCLC.

The significant switch from squamous cell carcinoma to adenocarcinoma was confirmed over time. While, TTF1 test was a routine practice, access to molecular testing, yet improved over time remains very limited and incomplete. The spectrum of mutation is not known, in previously published series, authors identified a predominance of the rare EGFR mutation p.L861Q in 35.3% of cases, suggesting unique genetic profiles among Tunisian patients [17,18].

Recent advances have identified numerous actionable driver mutations, such as EGFR, ALK, BRAF, and others, in lung cancer, enabling effective personalized therapies using targeted treatments like Tyrosine Kinase Inhibitors and anti-HER2 agents. To guide clinicians to the most suitable therapy, most of the Tunisian centers rely on single gene mutation testing to identify variants in genes like EGFR. By using classical sanger sequencing, only hotspots on EGFR Exons 18-22 are tested which limits the simultaneous identification of other actionable mutations in other genes including those involved in drug resistance and therefore limits the therapeutic options for patients. Shifting from single-gene mutation testing to high coverage targeted sequencing using NGS based Pillar Multi- Cancer panel of 60 genes including EGFR, ALK, ROS1, BRAF, RET, NTRK, HER2, KRAS and MET was performed locally on formalin-fixed paraffin-embedded tissues from patients with NSCLC. Using this panel, a full range of variation, including single-nucleotide variants (SNVs), insertions/deletions, translocations and copy number Variation (CNVs) can be detected by DNA sequencing. Fusion alterations on genes like NTRK, ROS1 and ALK can also be detected by RNA sequencing using the same gene panel. Several challenges related to the quantity and quality of DNA/RNA extracted from the formalin-fixed, paraffin embedded (FFPE) tissue have been faced. Indeed, it is well known that formalin fixation results in DNA damage and compromises its integrity which negatively impacts NGS Data quality. More efforts should be made at the pre-analytical steps to improve the quality of the used biological material. Liquid biopsy is also under implementation as an alternative to the standard fixed tissue-based approach[19].

NSCLC survival remains poor in Tunisia. In a study of young patients, the median survival was reported at 8 months, with performance status and elevated CRP levels as significant prognostic factors [8]. In another study, the mean survival was 11-12 months, with a 5-year overall survival rate of 0% [11]. In our series, survival improved to 14 months in stage IV. The management of NSCLC in Tunisia is heavily influenced by limited resources, which determine access to expensive novel treatments such as immunotherapy and targeted therapy[20]. The high cost of targeted therapy and IO makes them not affordable for the majority of patients and even for the health care system that cannot reimburse them [21,22]. Furthermore, prescribing and administering these treatments necessitates comprehensive molecular biomarker testing, which remains both costly and largely unavailable in Tunisia. This critical testing is not covered by public insurance systems, posing a significant financial barrier for many patients. Research initiatives supported by international funding, such as the PERMEDINA project [19], hold promise in addressing these challenges. Such projects can help develop local expertise in sequencing technologies and enhance patient access to precision medicine by fostering capacity-building and resource development. In our series, the majority of patients with druggable mutations were unable to receive any targeted therapy. Conversely, some patients were able to access up to three sequential drugs, underscoring a significant equity issue in treatment distribution. These disparities are further exacerbated by the irregular availability of novel therapies, largely driven by pharmaceutical supply challenges, which pose an additional barrier to consistent and equitable care [23]. Implementing precision medicine in resource-limited settings often forces oncologists to make difficult decisions, prioritizing younger patients and non-smokers for molecular testing. In such contexts, treatment typically begins with conventional chemotherapy while awaiting access to immunotherapy (IO) or targeted therapies. This approach frequently results in first-line treatments relying on conventional chemotherapy, followed by maintenance or subsequent lines of novel therapies. Unfortunately, these advanced treatments are often administered on an intermittent basis due to their irregular availability, which compromises treatment continuity and overall effectiveness. These adapted protocols are not evidence-based medical service and may not have the same outcomes as the validated international protocols.

-Policy implications: To address these disparities and financial difficulties, potential solutions might include negotiations with pharmaceutical industries to: reduce pricing, implement compassionate use programs, and make fund companion tests or adopt a risk-sharing agreement [24,25]. Such negotiations should include multidisciplinary teams: physicians and policy makers. Encouraging Asian pharmaceutical industries that manufacture generic IO and targeted treatments to settle in the Tunisian

pharmaceutical market or to conduct their registration trials in Tunisia, could also improve access to novel treatments with more reasonable pricing. Participation in international clinical trials can provide access to cutting-edge treatments and should be encouraged by facilitating the process of including Tunisia in such trials. Exploring innovative funding models, such as community engagement, crowdfunding, and dedicated cancer funds, can contribute to better access to molecular testing and novel treatments [26]. To improve access to unaffordable treatments, several NGOs worldwide have partnered with healthcare providers in Tunisia to support patients in need. Notably, organizations like the MAX Foundation have played a pivotal role in enabling patients with ALK-positive metastatic NSCLC to access crizotinib for several years, with more than 35 included Tunisian patients, demonstrating the potential of such collaborations to bridge treatment gaps in resource-limited settings. Also, community engagement, crowdfunding, dedicated cancer funds and other innovative funding models could contribute to better access to molecular testing and novel treatments. To the date of this publication, chemotherapy is the only reimbursed drug, in our series patients who received targeted therapy or immunotherapy had to pay it out of pocket or get it through a compassionate use program. Our results showed better survival was observed in patients who received targeted therapy and immunotherapy.

The strengths of this study include the large sample size, comprehensive reporting on management practices, outcomes, and timelines, and its ability to reflect real-world clinical practices over the past decade. However, several limitations should be acknowledged. The retrospective design inherently relies on the completeness and accuracy of medical records, which may exclude patients with incomplete data—many of whom may have died before accessing therapy. Our analysis was subject to potential bias due to missing data. However, we minimized this limitation by excluding patients with insufficient follow-up or excessive missing information, thereby preserving the reliability of our findings.

Additionally, the study population is limited to the northern Tunisia, where healthcare resources are more concentrated, potentially underrepresenting the greater challenges faced in the central and southern regions with less resources. Some patients in poor general condition may not have been referred to specialists for diagnosis, introducing further bias. The “Tunisian Lung Cancer Study (LUNG-TUN)” is an ongoing prospective, multicenter, observational, national study representing all regions of Tunisia. Eligible patients will be recruited consecutively among subjects with proven lung cancer, including any disease stage with clinical, therapeutic and evolutive description. (ID: NCT06934499). The results of the LUNG-TUN study would show better representation of the Tunisia population.

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