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RESEARCH

Clinical characteristics, treatment patterns and outcomes of patients with follicular lymphoma in Colombia: a real-world evidence cohort study

Leonardo Enciso[1] · Farley Johanna González[2] · Luz E. Pérez[2] · Ana María Ramos[3] · Daniel Samacá-Samacá[3] · Carlos Badillo[3]

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Abstract

Follicular lymphoma (FL) is the second most common mature B lymphoid neoplasm. Understanding its epidemiology and clinical features is crucial for developing healthcare strategies, especially in low-and middle-income countries. This retrospective study analyzed clinical features, treatment patterns and outcomes of FL patients in a Colombian Health Maintenance Organization from 2018 to 2023. Statistical analyses were descriptive; survival was assessed using the Kaplan-Meier method. A total of 406 patients were included (mean age: 55.7 ± 13.8 years; 59.4% women). 79% of patients were classified as Ann Arbor stage III-IV, and 35% as high-risk in the FLIPI score. Most frequent first line (1 L) treatments were R-CHOP (63.5%) and R-CVP (10.8%), with 77.3% of patients achieving complete response (CR). Progression to second line (2L) therapy occurred in 30% of patients; 82% achieved CR. Most frequent 2L treatments were radiotherapy (23%), obinutuzumab-based regimens (18%) and R-Bendamustine (18%). Five-year progression-free survival was 70.4%, and overall survival at 5 and 10 years was 92% and 85%, respectively. A lower risk of death was observed in patients with low-intermediate FLIPI compared to patients with high FLIPI (HR = 0.23; 95%CI: 0.11–0.49). Patients with progression in the first 24 months (POD24) had a higher risk of mortality (HR = 6.54; 95%CI = 2.73–15.43). We report an approximation of the current status of FL in Colombia. Findings showed high response rates to initial treatment and prolonged overall survival. The presence of a high FLIPI score and POD24 were associated with an increased risk of mortality.

Keywords Follicular lymphoma · Treatment patterns · Survival · POD24 · Colombia

Introduction

Follicular lymphoma (FL) is the second most common type of mature B-lymphoid neoplasm, with an estimated incidence of 3.5 cases per 100,000 inhabitants, predominating in males and increasing with age [1]. In developing countries, it accounts for more than 25% of cases on non-Hodgkin lymphoma (NHL), compared to 15% in developed countries [1]. The majority of patients are diagnosed at an advanced stage, with less than 20% presenting at stage I or II [2]. The disease is characterized by a heterogeneous clinical presentation with a highly variable prognosis [3].

The diagnosis of FL enables the categorization of patients into risk groups using prognostic scales, which may include clinical and laboratory variables, such as FLIPI and FLIPI2, or genetic testing, m7-FLIPI [4]. Diagnosis of FL requires an adequate lymph node biopsy. Colombian guidelines recommend excisional biopsy for superficial easy accessible lymphadenopathy, reserving more invasive methods as ultrasound or CT guided core needle biopsy for deep-seated lymphadenopathy [5]. Histologically, FL is graded by the number of centroblasts present per high-power field. Grade 3B cases are more aggressive and require intensive treatment; therefore, the distinction between Grade 3A and 3B is crucial for treatment decisions [6].

✉ Daniel Samacá-Samacá
daniel.samaca@roche.com

[1] Hemato-Oncology Division, Clinical Research Unit, Centro de Biociencias SURA, Medellín, Colombia

[2] Clinical Research Unit, Centro de Biociencias SURA, Medellín, Colombia

[3] Evidence Generation, Roche, Bogotá, Colombia

Although FL is considered incurable, relative survival has improved. In the United Kingdom, the 5-year survival probability was estimated at 86.5%, in part due to the use of rituximab in first line treatment [7]. However, patients may still experience early disease progression. A key factor in the prognosis of the disease is the identification of patients with progression of disease within 2 years (POD24), in whom a poor prognosis and shorter overall survival have been reported, highlighting the need to develop new effective therapies [8, 9].

First line treatment has rapidly evolved, with the incorporation of monoclonal anti-CD20 antibodies, The combination of chemotherapy with a monoclonal antibody has been established as the standard of treatment for patients with high tumor burden [4]. Different chemotherapy regimens can be used, such as CHOP and CVP. It has been found that that the combination of bendamustine and rituximab is non-inferior to CHOP, with better progression-free survival and less toxicity [10]. Additionally, clinical trials have shown that use of rituximab and obinutuzumab improves progression-free survival (PFS), with obinutuzumab being superior to rituximab in long term overall survival [11, 12]. More recent advances include the development of bispecific antibodies and CAR-T cell therapies which have shown benefit in relapsed FL with complete response rates exceeding 60% [13, 14].

Information on local disease behavior and treatment patterns is important to understand the prognosis of Colombian patients. A retrospective study that collected data from 819 patients with lymphoma in Colombia between 2000 and 2013 showed that FL constituted 11.7% of NHL, being the second most common histological type [15]; in this study, the authors found that the 3-year overall survival of patients with FL was 77%. However, additional information on the characteristics of patients with FL, or the association of survival according to clinical variables was not assessed.

Clinical features, long-term survival and first-line or subsequent therapy in routine practice in the country have not been clearly established. Information on overall survival and event-free survival is limited to single-center studies. Characterizing the population with FL in a larger, nationwide cohort could better define areas needing strengthening in comprehensive care for these patients. This could lead to improved health management indicators through the implementation of enhancement strategies. The study aimed to analyze clinical features, treatment patterns and outcomes of FL patients in a Colombian Health Maintenance Organization (HMO) from 2018 to 2023.

Methods

This observational retrospective study analyzed clinical data of adult patients with confirmed FL diagnosis treated in a Colombian HMO between January 2018 and June 2023. Data were obtained through patient chart review of electronic medical records and claim databases according to ICD-10 diagnosis codes related to the disease (Supplementary table S1). Patients with 3B FL, human immunodeficiency virus (HIV) infection and incomplete information regarding the type of treatment they received were excluded. All data were de-identified and collected by a trained team in a centralized database. Quality control of the data was performed by an external auditor to ensure reliability, including completeness, consistency and accuracy.

Socio-demographic data, including sex, age, city of residence, insurance affiliation regimen and vital status at the end of the period were collected. Clinical data included date of diagnosis, disease stage (based on Lugano classification), Follicular Lymphoma International Prognosis Index (FLIPI) score, Eastern Cooperative Oncology Group (ECOG) performance status, Ann Arbor staging, comorbidities, bone and extranodal involvement and B symptoms. Data regarding treatment patterns included first to third lines of treatment regimens, date of initiation, clinical response, status and date of disease progression, number of cycles received and data regarding autologous stem cell transplantation. The first regimen prescribed to the patient after the diagnosis was considered as the first-line therapy. The subsequent lines were defined by the initiation of different treatments after disease progression. Maintenance therapy with rituximab and obinutuzumab were registered.

Statistical analysis

Descriptive statistics were used to summarize continuous variables, including measures of central tendency (mean and median) with their respective dispersion measure (standard deviation, interquartile range). Shapiro-Wilk test was performed to determine the distribution of continuous variables. Absolute and relative frequencies were used to describe dichotomous variables. Time- to-event outcomes, including overall survival (OS), PFS and POD24 were assessed using the Kaplan-Meier (KM) method. The comparison of the probability of survival was performed using the log-rank test (statistical significance at $p<0.05$). To calculate the OS according to POD24, a risk-defining approach was used. The date of the first relapse was employed for patients who progressed within 24 months while time to progression after 24 months after diagnosis was used in patients without POD24 [16]. All analyses were conducted using R version 4.3.2.

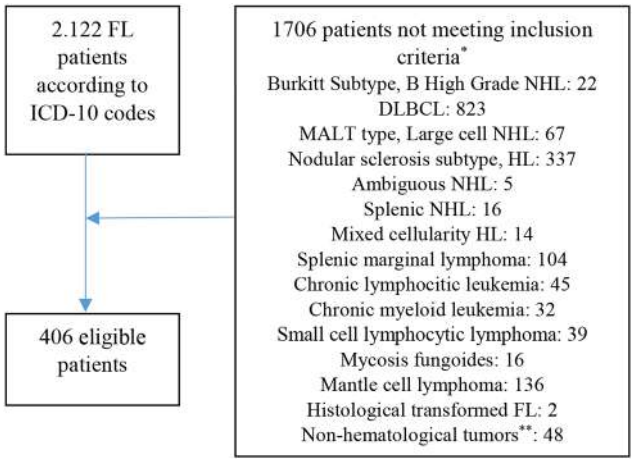

Fig. 1 Flowchart for patient selection. Abbreviations: FL: follicular lymphoma; NHL: non-Hodgkin's lymphoma; DLBCL: diffuse large B cell lymphoma; MALT mucosa- associated lymphoid tissue No patients met the exclusion criteria. * None of the patients met exclusion criteria ** Thyroid, Testicles, Lung, Breast

Results

Clinical characteristics

A total of 406 patients met the inclusion criteria (Fig. 1). The mean age of the patients was 55.7 years (standard deviation [SD] = 13.8 years), the median age was 56 (range 21–94), and 241 (59.4%) were female. Table 1 presents the demographic and clinical characteristics of the included patients. At baseline, 197 patients (48.5%) were classified as Ann Arbor stage III, and 124 (30.5%) as Ann Arbor stage IV. B symptoms were reported in 142 patients (34.9%). Functional status at diagnosis, assessed by the ECOG performance status, was recorded for 397 patients (97.8%), with 359 (90.4%) classified as ECOG 0 or 1. Among the 391 patients with available bone marrow data, 95 (24.3%) exhibited bone marrow infiltration. Similarly, elevated lactate dehydrogenase (LDH) levels were observed in 111 patients(28.0%) (Table 1).

Extranodal involvement was identified in 101 patients (24.9%), with 43.3% showing involvement of gastrointestinal system, 15.6% with skin involvement, and 12.4% with lumbosacral involvement. Other extranodal sites included the respiratory system (11%), nervous system and others. (Supplementary table S2). More than half of patients had involvement of 1 or 2 nodal areas (n = 231; 56.9%). Risk stratification using the FLIPI score was available for 404 patients (99.5%). Of these, 111 patients (27.3%) were classified as low risk, 151patients (37.2%) as intermediate risk, and 142 patients (35.0%) as high risk. The most frequently affected nodal areas were the cervical region in 207 patients (51.0%), the mesenteric region in 200 patients (49.3%),

Table 1 Demographic and clinical characteristics of the study population

Variable	(n = 406)	
	Frequency	Percentage (%)
Age		
Mean (SD)	55.7 (13.8)	
Median (range)	56 (21–94)	
Sex		
Male	165	40.6
Female	241	59.4
ECOG		
0	176	43.3
1	183	45.1
2	36	8.9
3	2	0.5
4	0	0.0
No data	9	2.2
FLIPI score at diagnosis		
Low	111	27.3
Intermediate	151	37.2
High	142	35.0
No data	2	0.5
Ann Arbor staging		
I	21	5.2
II	62	15.3
III	197	48.5
IV	124	30.5
No data	2	0.5
B symptoms		
Yes	142	34.9
No	252	62.1
No data	12	3.0
Extranodal involvement		
Yes	101	24.9
No	301	74.1
No data	4	1.0
Bone marrow involvement		
Yes	95	23.4
No	296	72.9
No data	15	3.7
Comorbidities		
Arterial hypertension	107	26.4
Type II diabetes mellitus	27	6.7
Heart failure	4	1.0
Liver Disease	3	0.7
COPD	10	2.5
CKD	10	2.5
Other conditions*	22	5.4
No disease	223	54.9
Autologous transplant		
Yes	14	3.5
No	392	95.5

Abbreviations: ECOG: Eastern Cooperative Oncology Group Performance Status, CKD Chronic kidney disease, COPD: Chronic obstructive pulmonary disease, FLIPI: Follicular Lymphoma International Prognostic Index

*Others include: hypothyroidism, rheumatoid arthritis, dyslipidemia

and the paraaortic region in 134 patients (33.0%). Regarding comorbidities, 223 patients (54.9%) had no prior medical conditions; however, among those with a pathological history, hypertension was the most prevalent comorbidity, affecting 107 patients (26.4%).

Treatment patterns and clinical outcomes

The treatments received in each therapeutic line are presented in Table 2. Regarding the first-line treatment, the most frequent regimen was R-CHOP in 258 (63.5%) patients followed by the anthracycline-free regimen R-CVP in 44 (10.8%) patients and clinical surveillance in 42 (10.3%). R-Bendamustine, radiotherapy, rituximab monotherapy and obinutuzumab-based regimens were employed in less than 5% of patients. None of the patients received first-line treatment with lenalidomide-based regimens. The median number of first-line treatment cycles was six (interquartile range [IQR]: 6–6). A total of 275 (67.7) patients received maintenance therapy, of which 264 (95.6%) received rituximab and 12 (4.4%) received obinutuzumab.

Second-line therapy was initiated in 122 (30.0%) patients, among them, radiation therapy was the most common treatment ($n=28$; 22.9%) followed by regimens based on obinutuzumab and R-bendamustine in the same proportion ($n=22$; 18.0%). R-CHOP was used in 19 patients (15.6%). The median number of cycles was six (IQR: 4–6). Monoclonal antibody maintenance therapy was administered in 74 (60.6%) patients, of whom 58 (78.4%) patients received rituximab and 16 (29.6%) patients received obinutuzumab.

A total of 22 patients required a third line of therapy. Radiotherapy ($n=9$, 40.9%), R-ICE ($n=4$, 18.2%) and obinutuzumab-bendamustine ($n=3$, 13.8%) were the most used treatments among them. The average number of administered cycles of the third line of therapy was 4 cycles (IQR: 4–6).

The objective response rate (ORR) was high among the different lines of treatments (>80%) (Table 3). Complete response rates were achieved in 77.3%, 82.0% and 81.2% of the patients for first, second and third-line treatment regimens, respectively.

For survival analysis, data from the date of diagnosis from 2010 onwards was considered; prior to 2010, the information was considered unreliable; therefore, 380 patients were included. The median follow-up was 4.93 years (IQR: 4.47–5.62 years).

Two-year and five-year progression-free survival was 80.2% and 70.4%, respectively. The 5-year overall survival probability was 92% (95% CI: 89.0 −95.1%), and the 10-year survival probability was 85% (95% CI: 79.5 −91.7%). The median overall survival was not reached.

Table 2 Treatment patterns by treatment line

Treatment regimen	Line of therapy		
	First line, *n* (%) (*n*=406)	Second line, *n* (%) (*n*=122)	Third line, *n* (%) (*n*=22)
R-CHOP	258 (63.5)	19 (15.6)	1 (4.5)
R-CVP	44 (10.8)	10 (8.2)	0 (0.0)
Clinical surveillance	42 (10.3)	0 (0.0)	0 (0.0)
R-Bendamustine	19 (4.7)	22 (18.0)	1 (4.5)
Radiotherapy	13 (3.2)	28 (22.9)	9 (40.9)
Rituximab monotherapy	10 (2.5)	7 (5.7)	1 (4.5)
R-FCM	4 (1.0)	2 (1.6)	0 (0.0)
R-ICE	0 (0.0)	9 (7.4)	4 (18.2)
R-DHAP	0 (0.0)	2 (1.6)	0 (0.0)
R-GDP	0 (0.0)	1 (0.8)	0 (0.0)
G-CHOP	6 (1.5)	1 (0.8)	1 (4.5)
G-Bendamustine	6 (1.5)	19 (15.6)	3 (13.8)
G-CVP	0 (0.0)	2 (1.6)	1 (4.5)
Others*	4 (1.0)	1 (0.8)	1 (4.5)

Abbreviations: G-Bendamustine: Obinutuzumab, bendamustine, G-CVP: Obinutuzumab, cyclophosphamide, vincristine and prednisolone, G-CHOP: Obinutuzumab, cyclophosphamide, doxorubicin, vincristine and prednisolone R-Bendamustine: Rituximab bendamustine, R-FCM: Rituximab, fludarabine, cyclophosphamide, mitoxantrone, R-ICE: Rituximab, ifosfamide, etoposide and carboplatin, R-CVP: Rituximab, cyclophosphamide, vincristine and prednisolone, R-DHAP: Rituximab, dexamethasone, high-dose cytarabine and cisplatin, R-GDP: Rituximab, gemcitabine, dexamethasone and cisplatin, R-CHOP: Rituximab, cyclophosphamide, doxorubicin, vincristine and prednisolone. *Others include: Etoposide-CHOP, Hyper-CDA, Rituximab- cyclophosphamide, Obinutuzumab-Chlorambucil

Table 3 Response rates by treatment line

Treatment response*	First line, *n* (%) (*n*=406)	Second line, *n* (%) (*n*=122)	Third line, *n* (%) (*n*=22)
ORR	355 (87.4)	110 (90.2)	19 (86.4)
CR	314 (77.3)	100 (82.0)	18 (81.2)
PR	41 (10.1)	10 (8.2)	1 (5.2)
SD	42 (10.3)	2 (1.6)	0 (0.0)
Progression	9 (9.2)	10 (8.2)	3 (13.6)

Abbreviations: CR: complete response, PR: partial response, ORR: Objective response rate, SD: Stable disease. *According with Deauville criteria

The Kaplan Meier curve for overall survival is presented in Fig. 2.

The PFS was consistent among the population, where the PFS at 24 months was 80.2 (95% CI=76,2%-84,4%), 97.3% (95% CI=92.2,2-100%) and 81.5% (95% CI=64.33-100%) for the patients treated with R-CHOP, R-CVP and R-Bendamustine respectively. Similar results were found with another therapeutic schemes, including Obinutuzumab, were the PFS at 24 months was 100% in combination with Bendamustine, and of 83.3% (95% CI=58.3-100%) with CHOP.

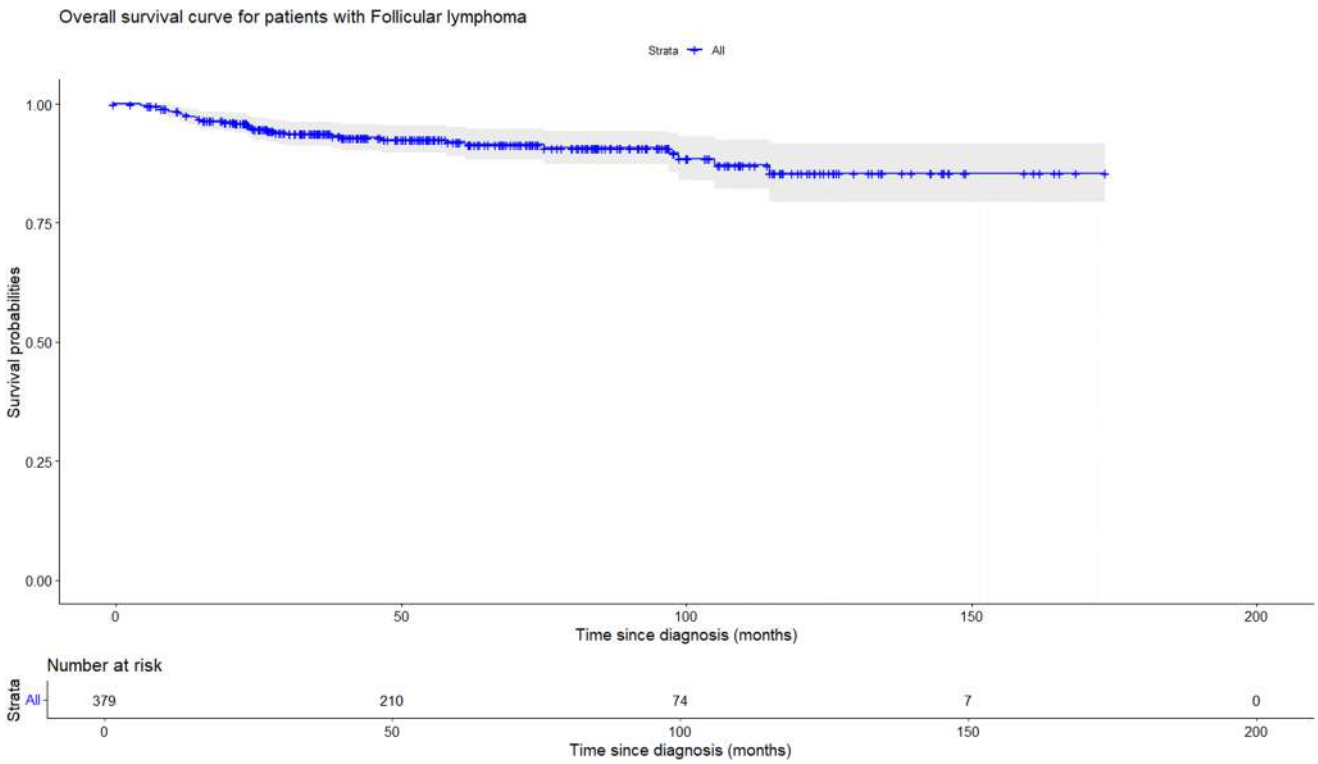

Fig. 2 Overall survival

Survival analyses were conducted based on different clinical characteristics. Overall survival was assessed according to FLIPI category at the time of diagnosis. The median follow-up was similar across the FLIPI groups, with a median of 4.58 years for patients at high risk, 5.71 years for patients at intermediate risk, and 4.7 years for patients at low risk. Of the 32 recorded deaths, 22 patients were classified in the high-risk group, 8 patients in the intermediate-risk group, and 2 patients in the low-risk group. The median survival was not reached in any of the groups.

A reduction in the risk of death of 88% and 68% was identified for patients with low-risk FLIPI (hazard ratio [HR] = 0.11; 95% CI: 0.02–0.47), and intermediate-risk FLIPI (HR = 0.32; 95% CI: 0.14–0.73), compared to patients with high-risk FLIPI score, respectively. An analysis was performed grouping both low- and intermediate-risk FLIPI categories compared to high-risk FLIPI score. A statistically significant difference was observed between the high-risk category and the low- and intermediate-risk FLIPI group (HR = 0.23; 95% CI: 0.11–0.49), meaning that patients in the low- or intermediate-risk FLIPI group have a 77% reduction in the risk of death compared to those in the high-risk category (Fig. 3). Median overall survival was not reached in any of the groups by FLIPI score.

Overall survival was also assessed by Ann Arbor stage at diagnosis. No differences in survival were identified. Most patients were diagnosed at stage III or IV. Using stage I as the reference category, the following hazard ratios (HR) were found: HR = 0.55 (95% CI = 0.09–3.32) for patients with stage II; HR = 0.79 (95% CI = 0.18–3.51) for patients with stage III; and HR = 1.17 (95% CI = 0.26–5.18) for patients with stage IV.

Regarding the overall survival analysis according to disease progression within the first 24 months (POD24), a statistically significant increase in the risk of death was found in patients with early progression compared to those who did not progress in the first two years (HR = 6.54; 95% CI = 2.73–15.43) (Fig. 4).

Discussion

To our knowledge, this study represents the largest cohort of patients with follicular lymphoma (FL) analyzed in Colombia, contributing to the current understanding of the disease at the local level. The clinical characteristics of the included patients resemble those observed in other large international studies. For instance, the PRIMA study, which assessed maintenance therapy in 1,193 FL patients, with a median age of 56 years (range 22–87 years), similar to the one reported in our study (56 years; range 21–94 years), found a high proportion of patients in Ann Arbor III and IV stage (90%) and intermediate-high FLIPI risk in 79% of patients [11]. Our results were similar in showing the majority of patients in an advanced-stage disease (Ann Arbor III-IV: 79%), with intermediate-high FLIPI risk (72.2%), highlighting

the consistency of FL clinical presentations across diverse populations.

The high proportion of patients diagnosed at advanced stages has also been reported in other studies. Pavlovsky et al. found that among 578 patients with FL, 67.1% of patients were diagnosed at stage III or IV [17]. These findings are consistent with the known diagnosis pattern for FL, where approximately 78% of patients are diagnosed at advanced stages [4, 18]. It is worth mentioning that, while disease stage alone is not a determining factor for initiating treatment, advanced stages, particularly III and IV, are associated with a poorer prognosis [19], as shown in our study where intermediate and high FLIPI risk was associated with a higher risk of mortality.

We identified 27.3% of patients with elevated lactate dehydrogenase (LDH) levels at diagnosis, slightly higher than the 21% observed in the FLIPI cohort, but still within the expected range for this disease [18]. Regarding extranodal involvement, it was found in 24.9% of patients, which resembles the findings from other research. Our results show that the gastrointestinal tract, especially the intestines, and the skin where the most commonly affected extranodal sites. This is similar to the results of Lin et al., where the spleen, intestines, and parotid glands were also frequently involved areas (36.8%) [20].

Although several similarities with previously published studies were identified, supporting the consistency of the results, our study generated findings specific to the Colombian population. A notable result of our study was the lower frequency of bone marrow involvement (23.4%) compared to the cohort of patients analyzed for the construction of the FLIPI score, and the Hemato-Oncology Latin America Observational Registry study, where bone marrow involvement was 48% and 39.8%, respectively [17, 18], suggesting that regional differences may play a role in the clinical presentation of FL. Similarly, Lin et al. found that 33% of patients with FL had bone marrow involvement; furthermore, this was associated with an increased risk of progression or death (HR = 1.32; 95%CI: 1.05–1.66) [20].

In our study, it was not possible to perform a survival analysis according to the areas of involvement due to the sample size in each group; however, despite finding a lower percentage of patients with bone marrow involvement, considering the evidence on its relationship with survival, this variable can be considered as a possible poor prognostic factor in patients with FL [20]. However, it is important to mention that the identification of bone narrow infiltration was evaluated by bone marrow biopsy, instead of PET. Although PET has been shown to be superior in detecting more extranodal disease sites [21], in Colombia, there is a limited availability of PET, with significant delays in access needed to initiate treatment. This highlights the challenges of resource availability at the local level and how country-specific characteristics must be considered in the interpretation of results.

Regarding the treatment patterns, the majority patients in our study received R-CHOP as their first-line treatment (63.5%), this is consistent with current treatment guidelines, including the NCCN, which recommend rituximab or obinutuzumab combined with chemotherapy for patients with high tumor burden [22], but also the Colombian clinical practice guideline on lymphoma management, which recommends as first line in transplant-eligible patients the use of anthracycline-based chemotherapy, such as R-CHOP [23], as the R-CHOP combination remains the standard of care due to its proven efficacy [4].

Despite radiotherapy being the most frequent treatment in the second-line setting, treatment regimens based on anti-CD20 antibodies plus chemotherapy were also used, as suggested per international guidelines [22]. Similar results of treatment patterns are reported in the literature. In a multicenter, retrospective study conducted in several hospitals across Latin America, 21.3% and 17.6% of patients with FL were treated with R-CHOP and R-CVP, respectively [24]. While Marcus et al. found that among 4,232 patients with FL in the United States the most common first-line treatments included bendamustine combined with rituximab (39%), R-CHOP (20%), and rituximab monotherapy (19%) [25].

Our study found an objective response rate to first-line treatment of 87.4% (complete response 77.3% and partial response 10.1%), which is consistent with those observed in other studies. In the GALLIUM study, 86.9% and 88.5% of patients randomized to the rituximab plus chemotherapy and obinutuzumab plus chemotherapy groups achieved an overall response rate, respectively [12]. It is worth mentioning that, although the number of patients treated with obinutuzumab-based regimens in our study was low, 93% of patients who received obinutuzumab-based regimens across all lines of treatment achieved a complete response.

We found higher complete response rates in the 2nd and 3rd lines of therapy compared to the 1st line. Although the objective of this study was not to evaluate the effectiveness between different therapeutic options, and there may be several factors contributing to this finding, this could be explained by the fact that nearly 18% of patients received a regimen based on obinutuzumab, which has demonstrated superior response rates compared to other treatments [12, 26]. Another possible explanation to consider is the proportion of patients who received radiotherapy (~23%), which was higher than the patients receiving salvage therapy. This might suggest that a greater number of cases presented localized disease at diagnosis, which increases the likelihood of a favorable response. Another interesting result in our study

was that PFS at 24 months with R-CHOP was 80.2% and 97.3% with R-CVP. However, it is important to mention that this finding may be due to the limited number of cases treated with R-CVP, which may result in less accurate estimations. Additionally, locally, there may be a tendency to avoid using anthracycline-based regimens in patients with a lower tumor burden at diagnosis.

The 5-year survival probability in our population was 92%, similar to values reported for others countries; Pavlovsky et al. found a five-year survival rate of 86.6% in Argentina, 87.3% in Chile and 95.3% in Mexico [17]. These high survival rates further support the use of monoclonal antibodies and chemotherapy in improving FL outcomes. Notably, the median overall survival has not been reached, since at the end of the period, 97.6% of patients included in the survival analysis were still alive. This is similar to the PRIMA and GALLIUM studies, where the median overall survival remained undefined even after long-term follow-up (around 36 months) [11, 12].

Progression in the first 24 months (POD24) has been identified as a significant predictor of poor survival outcomes [16]. In our study, patients who experienced disease progression in the first 24 months were associated with an increased risk of mortality compared with patients with late progression, which is consistent with recent studies highlighting POD24 as a critical prognostic marker [16, 27]. This finding underscores the importance of early disease progression in predicting long-term outcomes and suggests that patients with POD24 may benefit from more intensive treatment strategies.

Our study has some limitations, as a retrospective study, there are inherent limitations related to the completeness in the collection of certain variables. However, the availability of highly curated, structured data from the HMO data system increased the reliability of the information, which resulted in low portions of missing data. Another limitation in our study was the inability to collect detailed information on treatment-related toxicities. The lack of toxicity data, prevents us from drawing conclusions about the relative safety profiles of the different treatment regimens, accounting for the possible reasons for discontinuation of second- and third-line treatment. Future research in the area could address these limitations, which would complement the findings of our study.

It is important to add that, although the information is not derived from a national registry, the results are reasonably extrapolated to a national level, supported by the representativeness of the HMO. This is important when we consider that, in countries such as Colombia, no information system captures clinical data on all patients; however, some HMOs, such as the one analyzed in this study, cover a wide geographical region of the country, making it possible to characterize a broad population with significant potential to represent the national reality.

Therefore, one of the main strengths of this study is that our cohort includes patients from diverse geographical regions and healthcare centers across the country, reflecting the current real-world clinical approach in Colombia, providing a foundation for future clinical studies. Additionally, our study provides key findings, including long-term

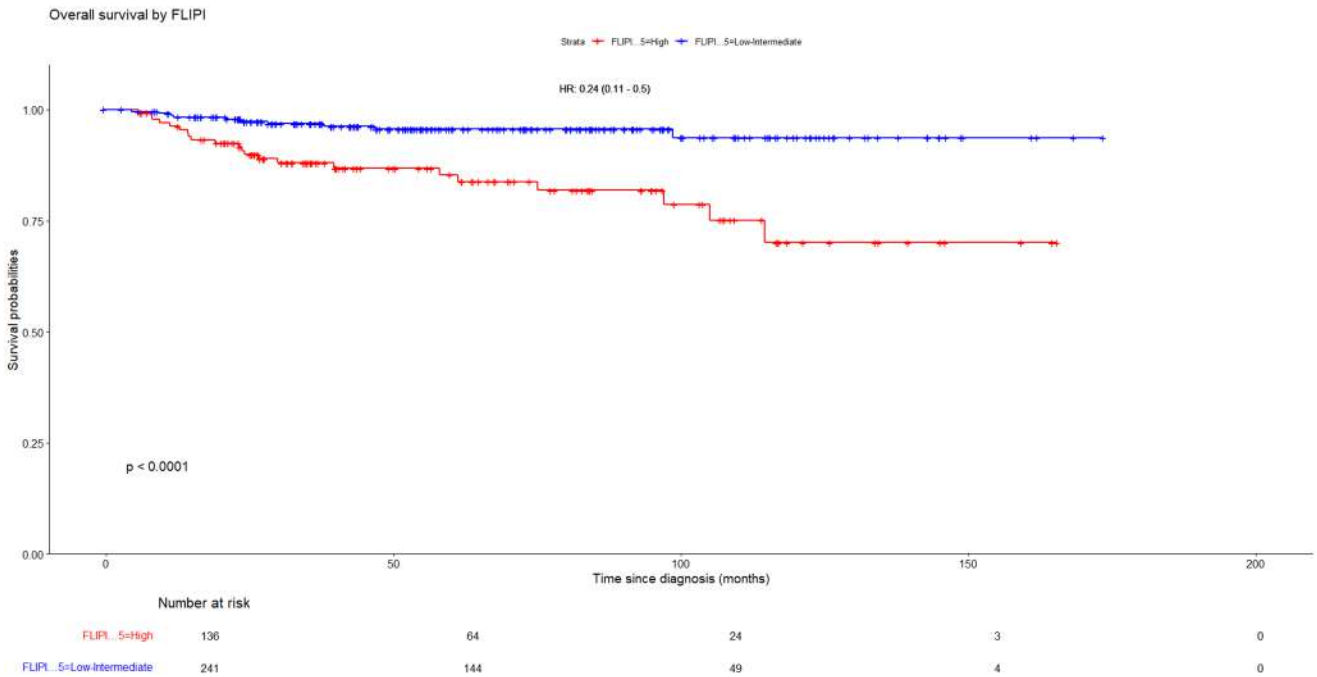

Fig. 3 Overall survival by FLIPI score at baseline

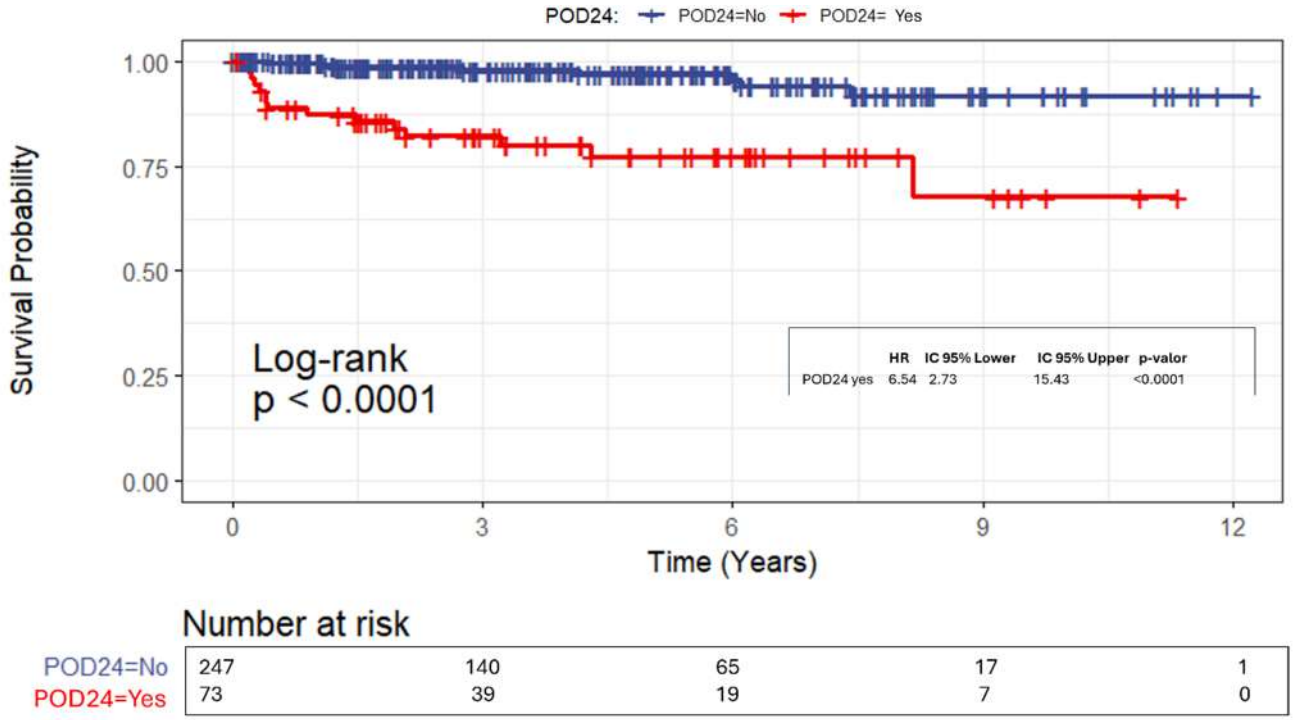

Fig. 4 Overall survival by POD24

survival, response rates and patterns of treatments, information that, so far, is poor across the country and the region.

Finally, we identified clinical variables, such as intermediate and high FLIPI risk, or rapid progression as factors that increase the risk of mortality, previously not reported locally, highlighting the importance of timely and effective treatment to improve population outcomes. These insights are crucial for improving our understanding of FL in Colombia and Latin America, where healthcare challenges and demographic characteristics may differ from those in other regions.

Conclusion

We report the clinical behavior and treatment patterns of FL in Colombia with findings similar to those reported in the literature, and results specific to our local context, contributing to the growing body of evidence on FL. We found high response rates to initial treatment, along with prolonged long-term survival. Additionally, we identified key variables, such as a high FLIPI score or progression within in the first 24 months as variables associated with higher mortality risk.

Up-to-date local evidence is crucial for designing healthcare strategies tailored to a population's specific needs, improving the understanding of a disease and a more efficient allocation of resources. By providing local data, our study supports research and informed healthcare management decisions. Ultimately, these results enable more strategic planning and resource distribution within Colombian healthcare institutions, leading to better care and a more sustainable healthcare system.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00277-025-06341-x.

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Data availability No datasets were generated or analysed during the current study.

Declarations

Ethical approval This study was approved by the "Comité de Ética y BPC en Investigación en Salud (CEI-Sura)," Carrera 48 # 26–50, Medellín, Colombia.

Consent to participate Patient consent was waived because this study

is retrospective, and the data were obtained from a secure database with anonymized information.

Competing interests Dr. Leonardo Enciso has had contracts in the last 36 months with Biotoscana, Jansenn and Sanofi, referring to advisory boards and pay lectures. The remaining authors declare no conflicts of interest. Dr. Carlos Badillo, Daniel Samacá-Samacá and Ana María Ramos are Roche employees.

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