



Follicular Lymphoma: POD24 today

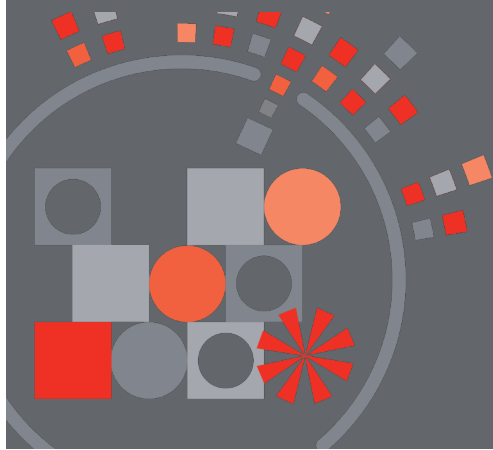
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THE UNIVERSITY OF TEXAS
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Disclosures

Consultant: Abbvie, Bayer, BeiGene, Celgene, Denovo Biopharma, Foresight Diagnostics, Genentech/Roche, Genmab, Gilead, Karyopharm, N-Power Medicine, Pharmacyclics/Janssen, SeaGen, Spectrum.

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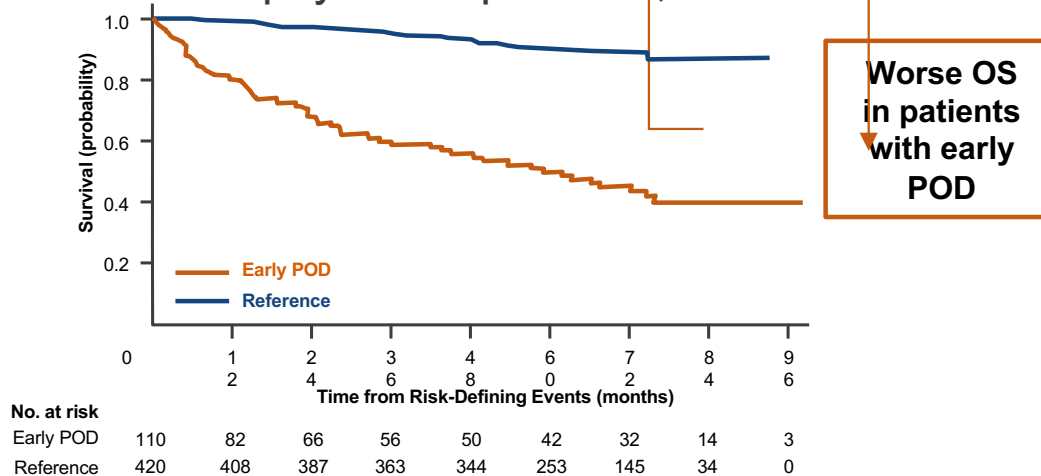
R/R FL: POD24 is associated with inferior survival

Early progression of disease (≤ 2 years) after frontline chemoimmunotherapy (POD24) occurs in approximately 20% of patients

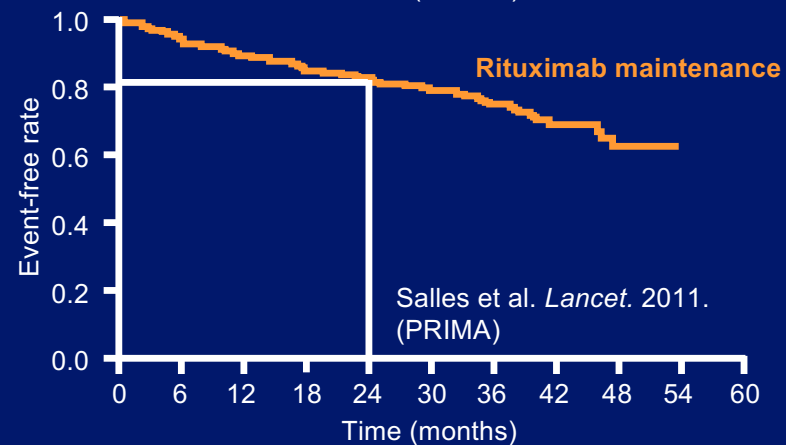
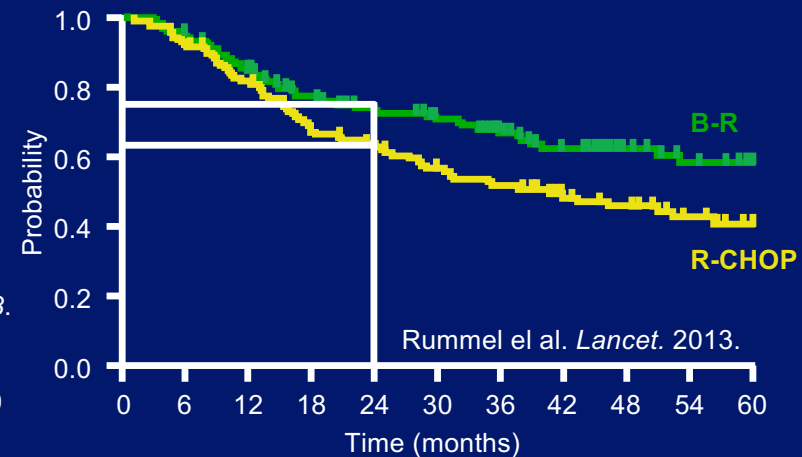
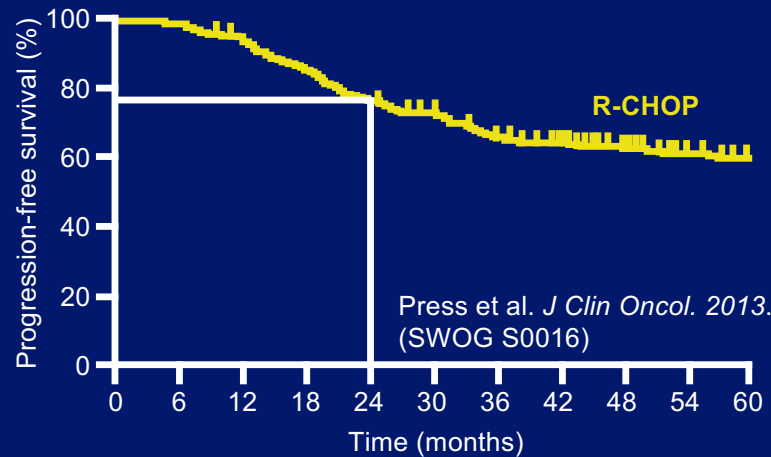
- Associated with a poor prognosis³
- Represents a population that should be targeted for trials.

Biopsy recommended to detect histologic transformation of FL, which is reported to occur at a rate of 2% per year¹

- If concerned for clinical transformation and biopsy is not pursued, would treat as DLBCL²



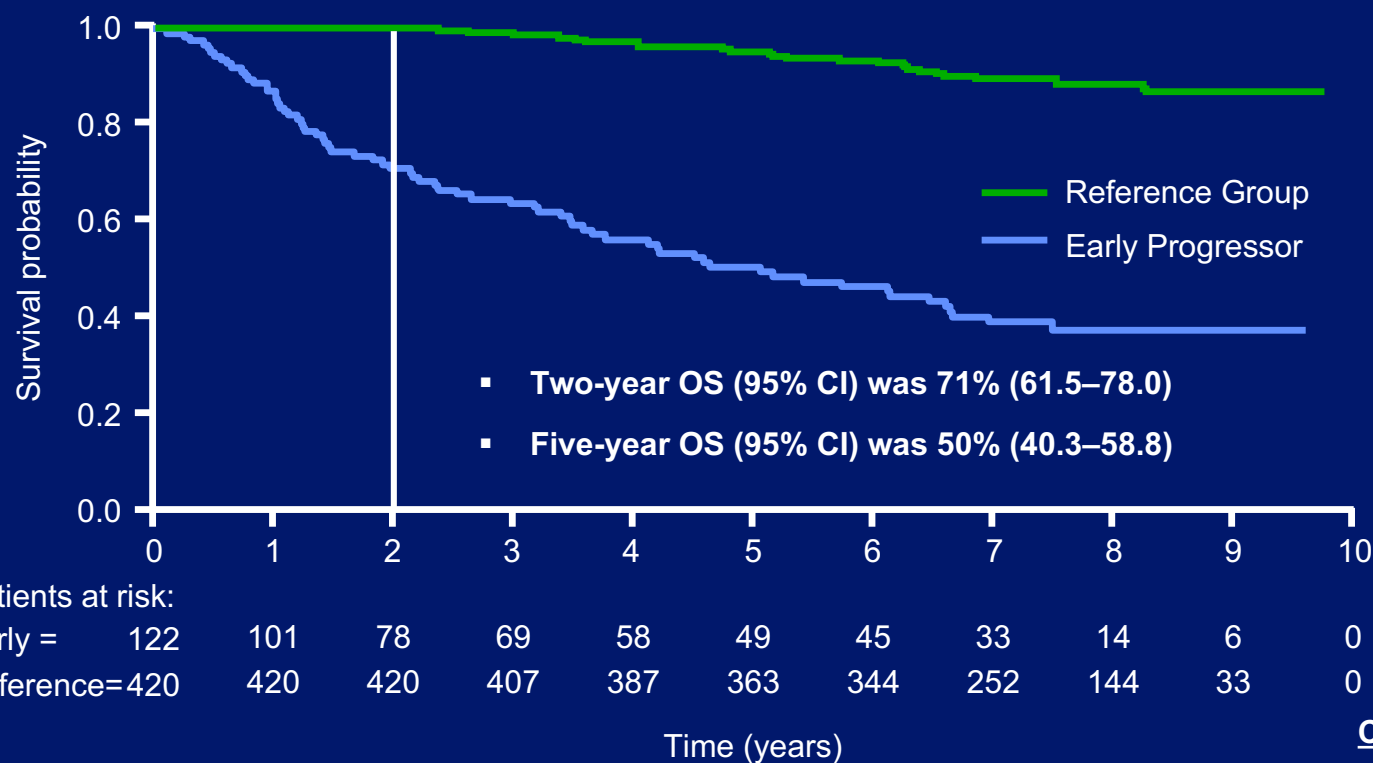
20% of Patients With FL Will Experience Disease Progression Within 24 Months of Treatment



FL includes high-risk group of patients who will relapse early despite different treatment approaches; maintenance

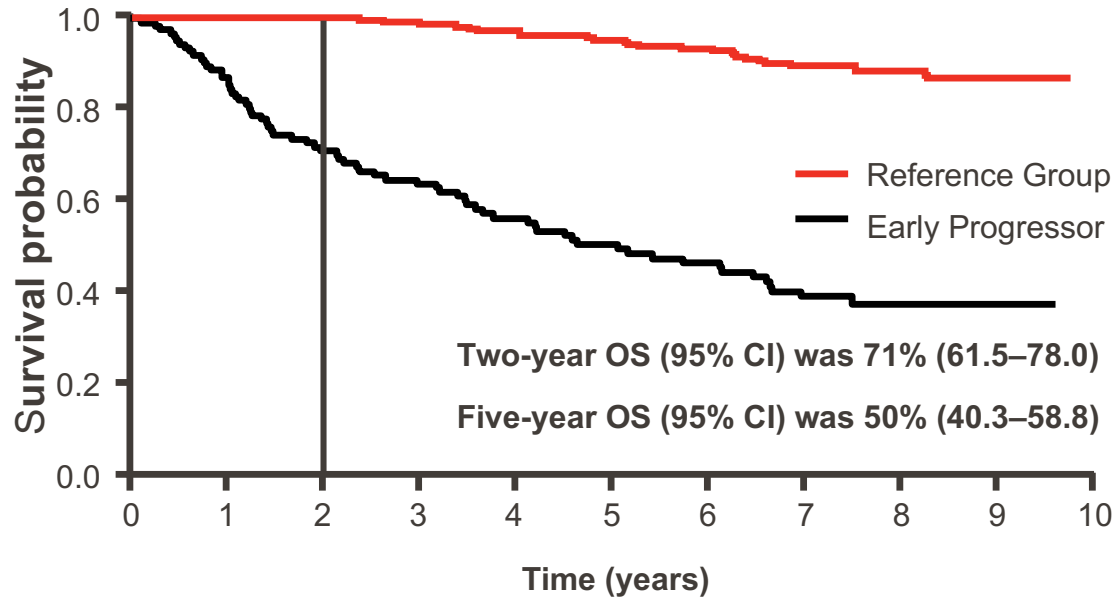
OS of Patients With FL Who Relapsed Within 2 Years of R-CHOP (“Early POD”) – National LymphoCare Study

- 122 patients were classified as early progressors



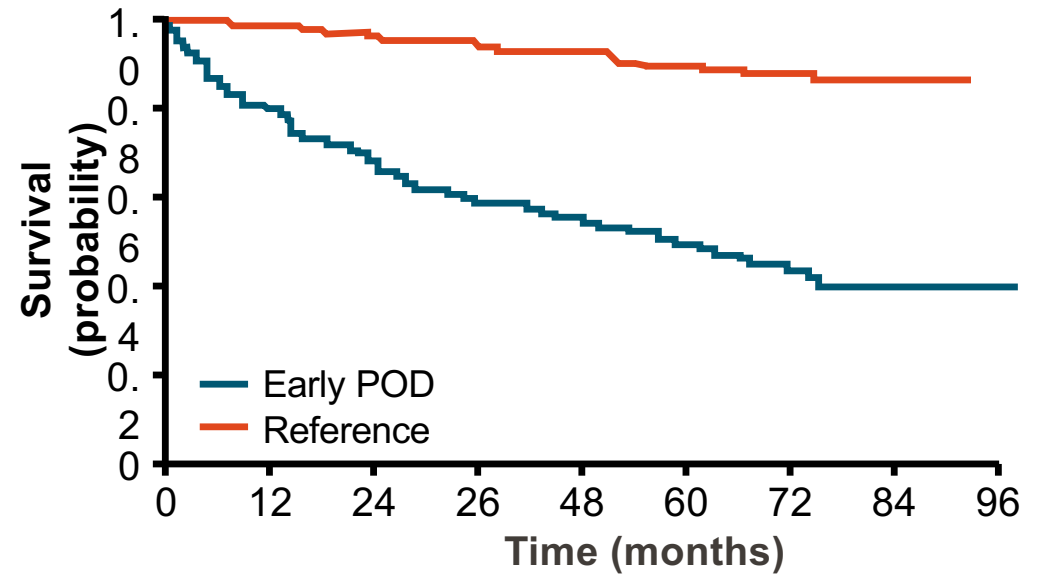
Connections Between Cohort Study and RCTs

NLCS: Survival With POD24 (n=542)
(progression < 24 months after initial therapy)



Casulo. *JCO*. 2015

FLASH: Survival With POD24 (n=5,453)
(progression < 24 months after initial therapy)



Casulo et al. *Blood*. 2022

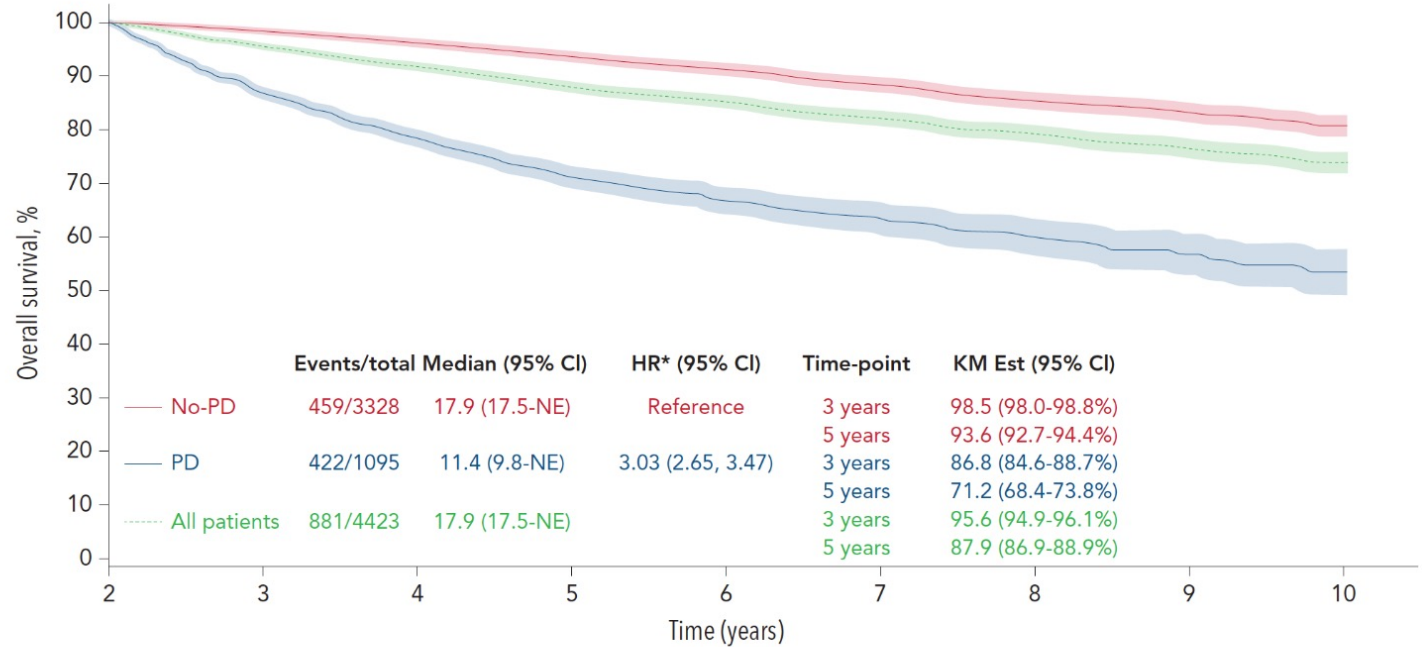
Progression of Disease in 24 Months Predicts Poor Survival

→ **POD24 predicted by:**

- Male sex
- Poor PS
- High-risk FLIPI
- Elevated β 2-microglobulin

→ **For patients with POD24, death more likely in:**

- Age >60
- Male sex
- PS \geq 2
- High-risk FLIPI
- Hgb <12
- Elevated β 2-microglobulin

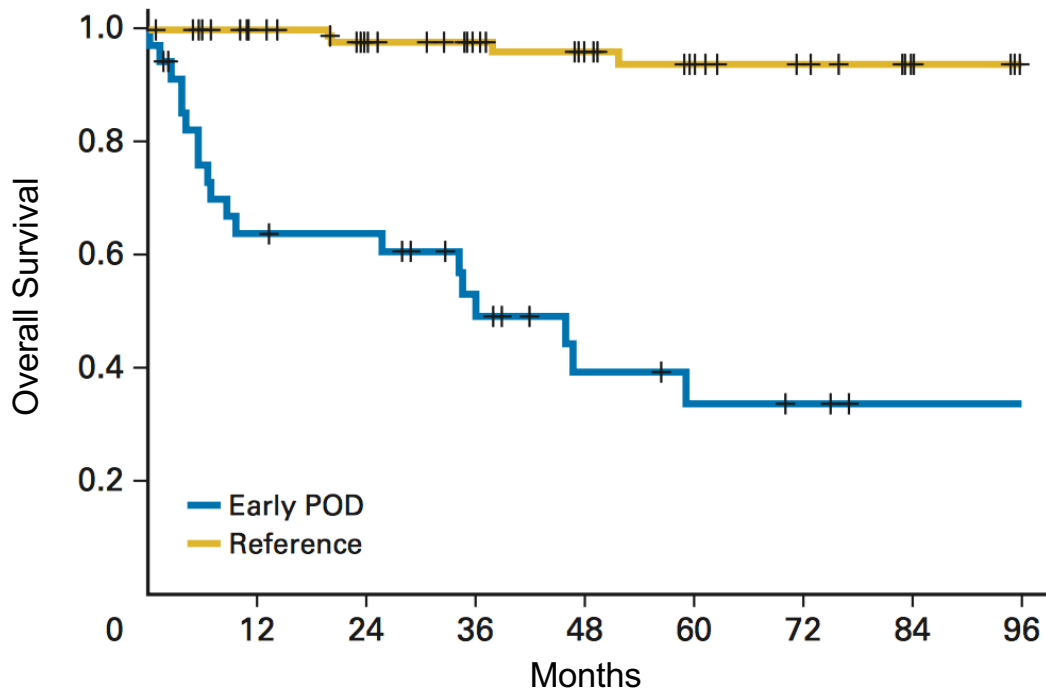


	Patients-at-risk								
No-PD	3328	3213	2833	2444	2062	1735	1302	1009	649
PD	1095	940	803	670	534	431	317	211	131
All patients	4423	4153	3636	3114	2596	2166	1619	1220	780

*Adjusted for gender; stratified by PS, FLIPI

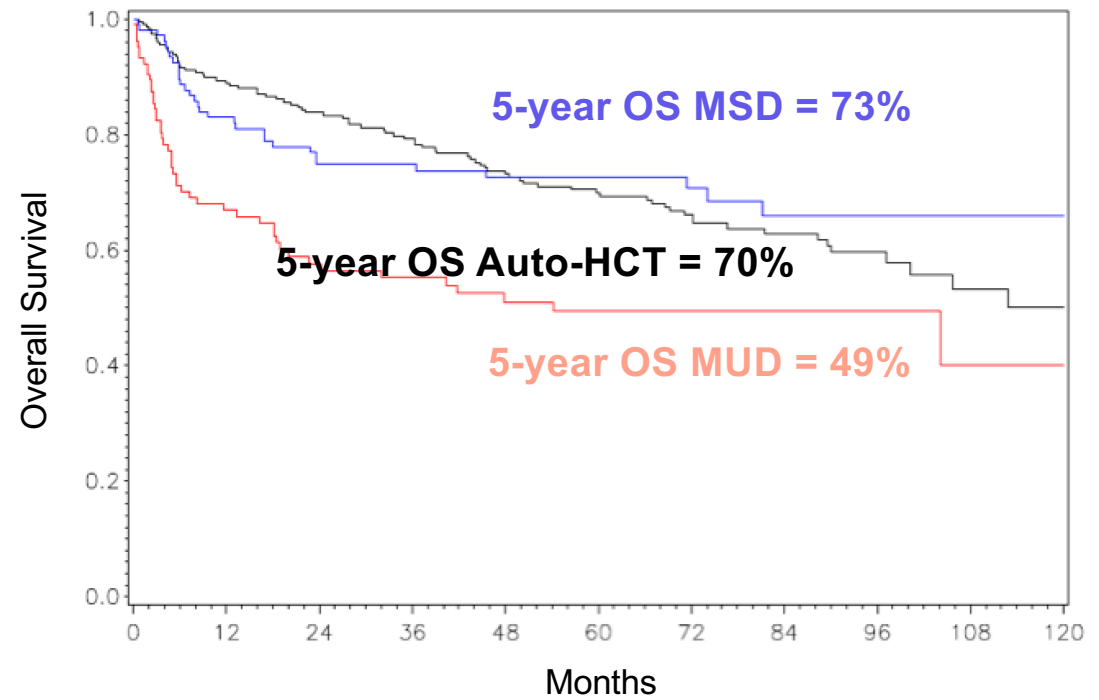
Placing SCT in Context

National LymphoCare Study



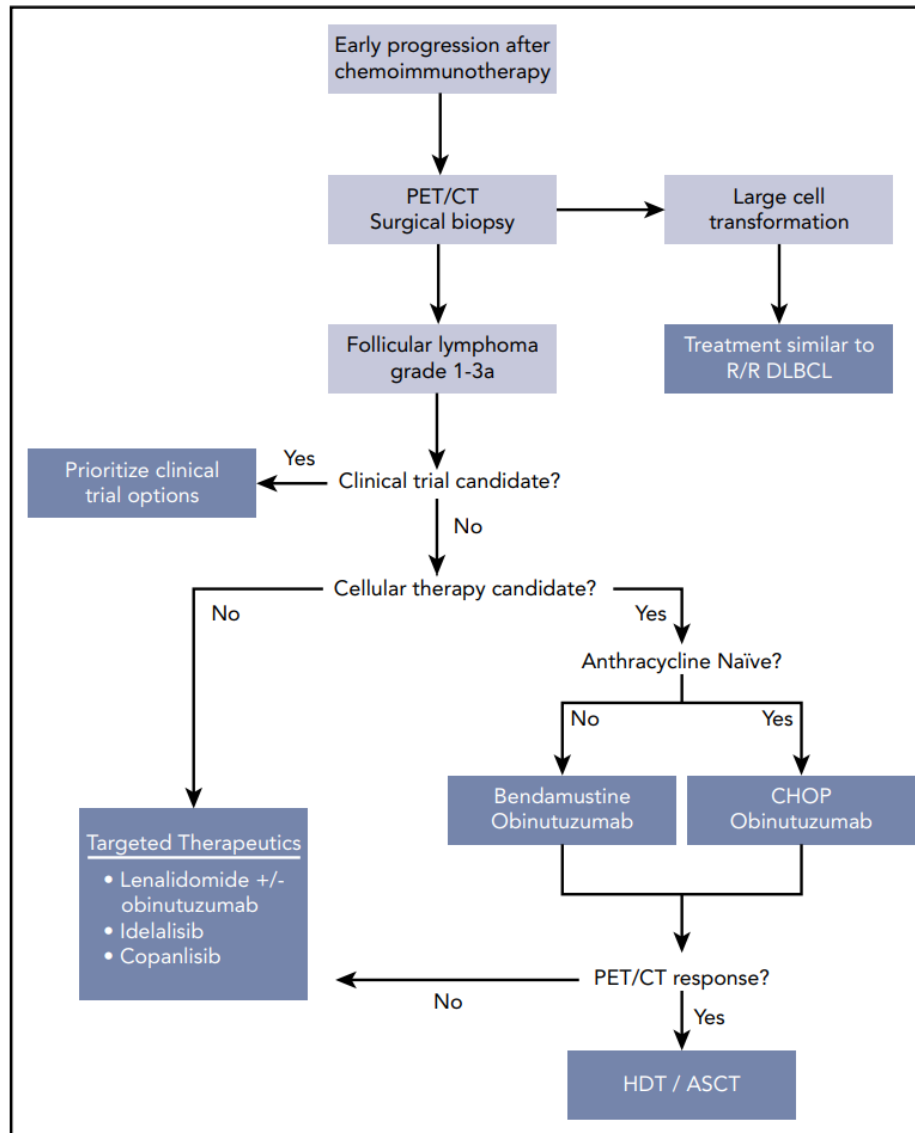
Casulo. *JCO*. 2015

CIBMTR Study



Casulo, et al. *Biol Blood Marrow Transplant*. 2017

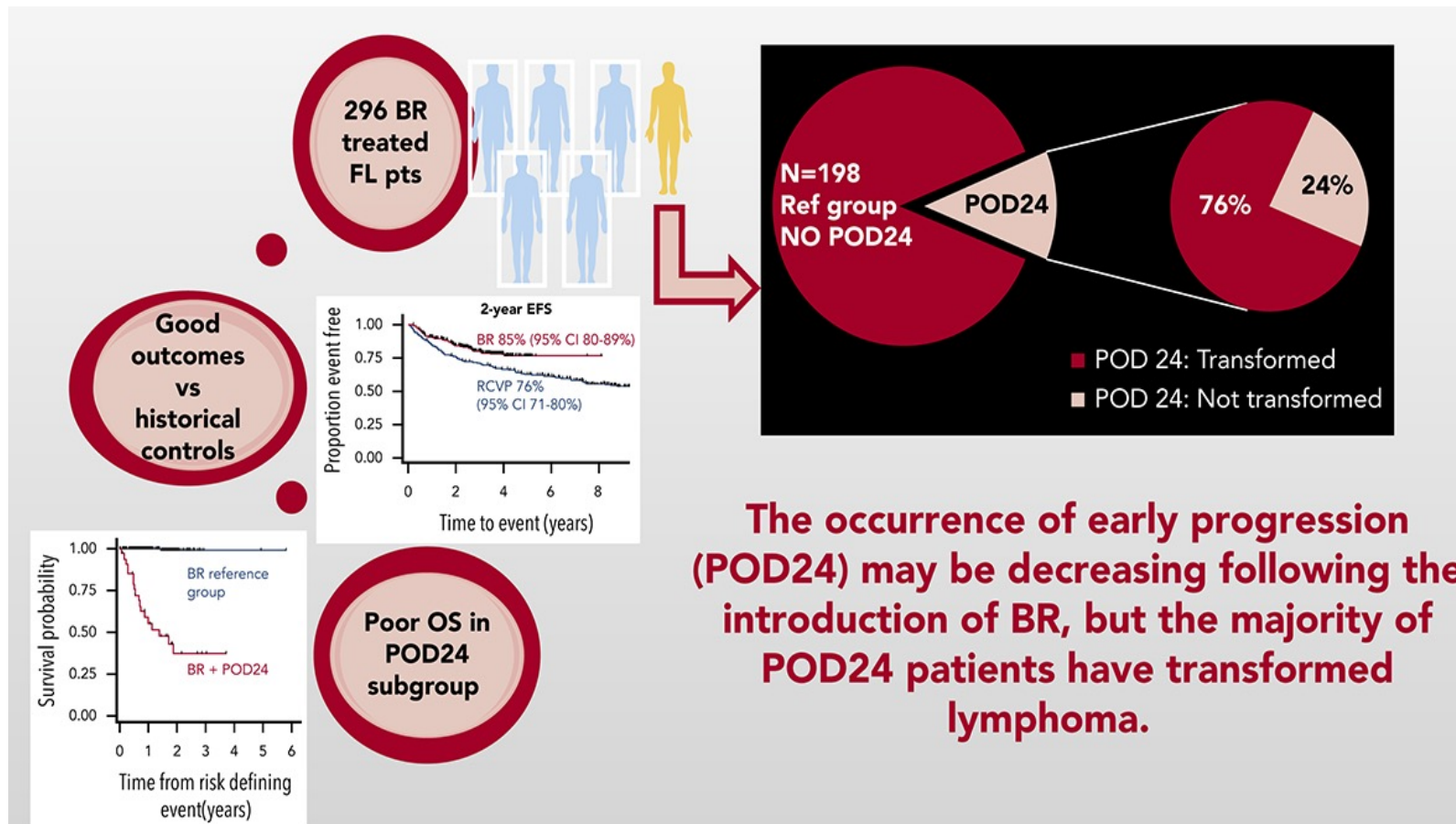
Management of Early Relapsed FL (<24 mos.)



Early Progression after BR Associated with Transformation

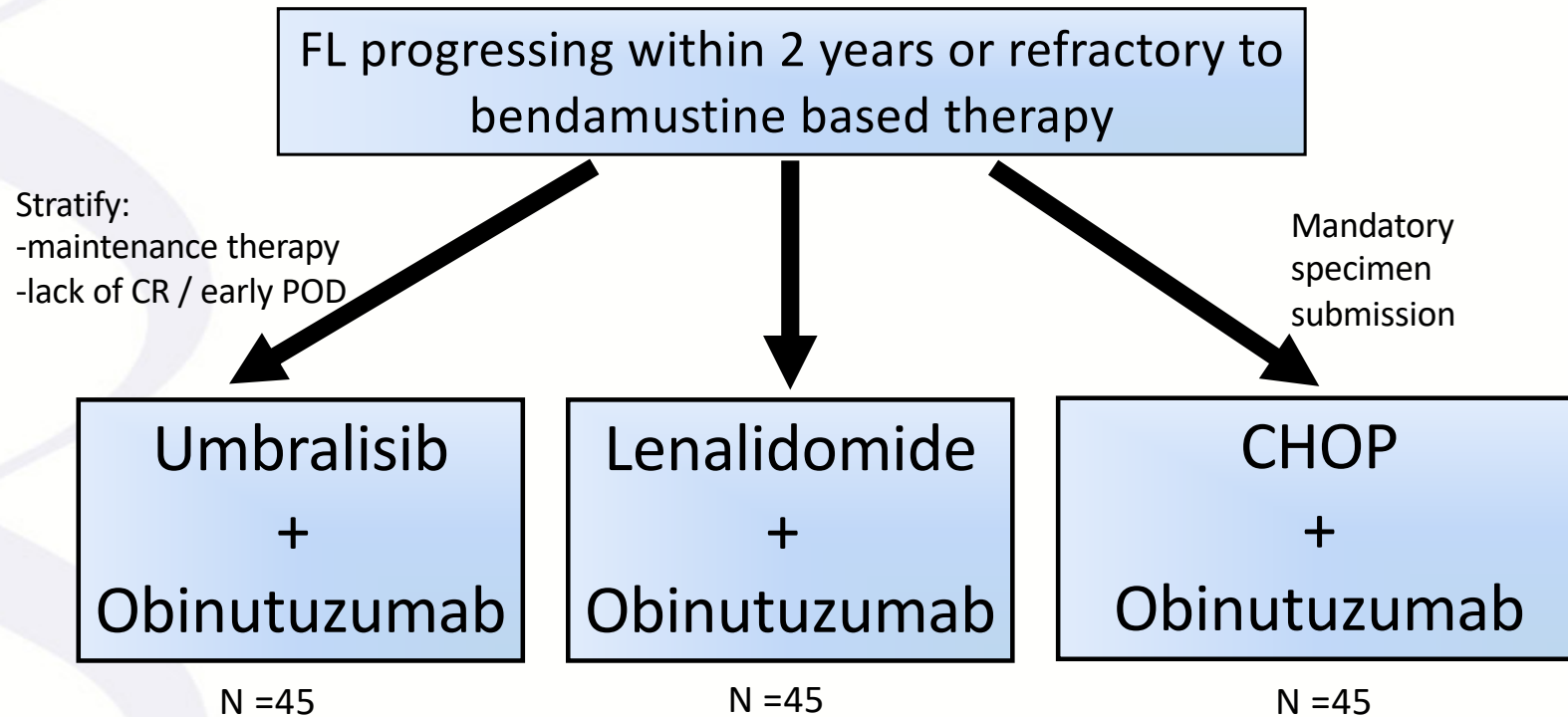
Study Overview

- Retrospective study of a population-based cohort of n=296 patients with advanced stage FL grades 1-3A
- Treated with frontline BR and maintenance rituximab
- POD24 was defined as progression or relapse, death from lymphoma, or treatment toxicity within 24 months of initiation of systemic therapy



S1608: Randomized phase II trial in early progressing or refractory FL

Paul Barr (SWOG), Brian Link (Alliance), Chris Flowers (ECOG)



Primary clinical objective: CR by PET/CT

Primary translational objective: Validation of m7-FLIPI in this high-risk population

Treatment patterns and outcomes of patients with relapsed or refractory follicular lymphoma receiving three or more lines of systemic therapy (LEO CReWE): a multicentre cohort study



Carla Casulo, Melissa C Larson, Julianne J Lunde, Thomas M Habermann, Izidore S Lossos, Yucai Wang, Loretta J Nastoupil, Christopher Strouse, Dai Chihara, Peter Martin, Jonathon B Cohen, Brad S Kahl, W Richard Burack, Jean L Koff, Yong Mun, Anthony Masaquel, Mei Wu, Michael C Wei, Ashwini Shewade, Jia Li, James Cerhan, Christopher R Flowers, Brian K Link, Matthew J Maurer

Summary

Background Novel therapies for relapsed or refractory follicular lymphoma are commonly evaluated in single-arm studies without formal comparison with other treatments or historical controls. Consequently, rigorously defined treatment outcomes informing expectations for novel therapeutic strategies in this population are sparse. To inform outcome expectations, we aimed to describe treatment patterns, survival outcomes, and duration of response in patients with relapsed or refractory follicular lymphoma receiving three or more lines of systemic therapy.

Lancet Haematol 2022;
9: e289–300

See [Comment](#) page e241

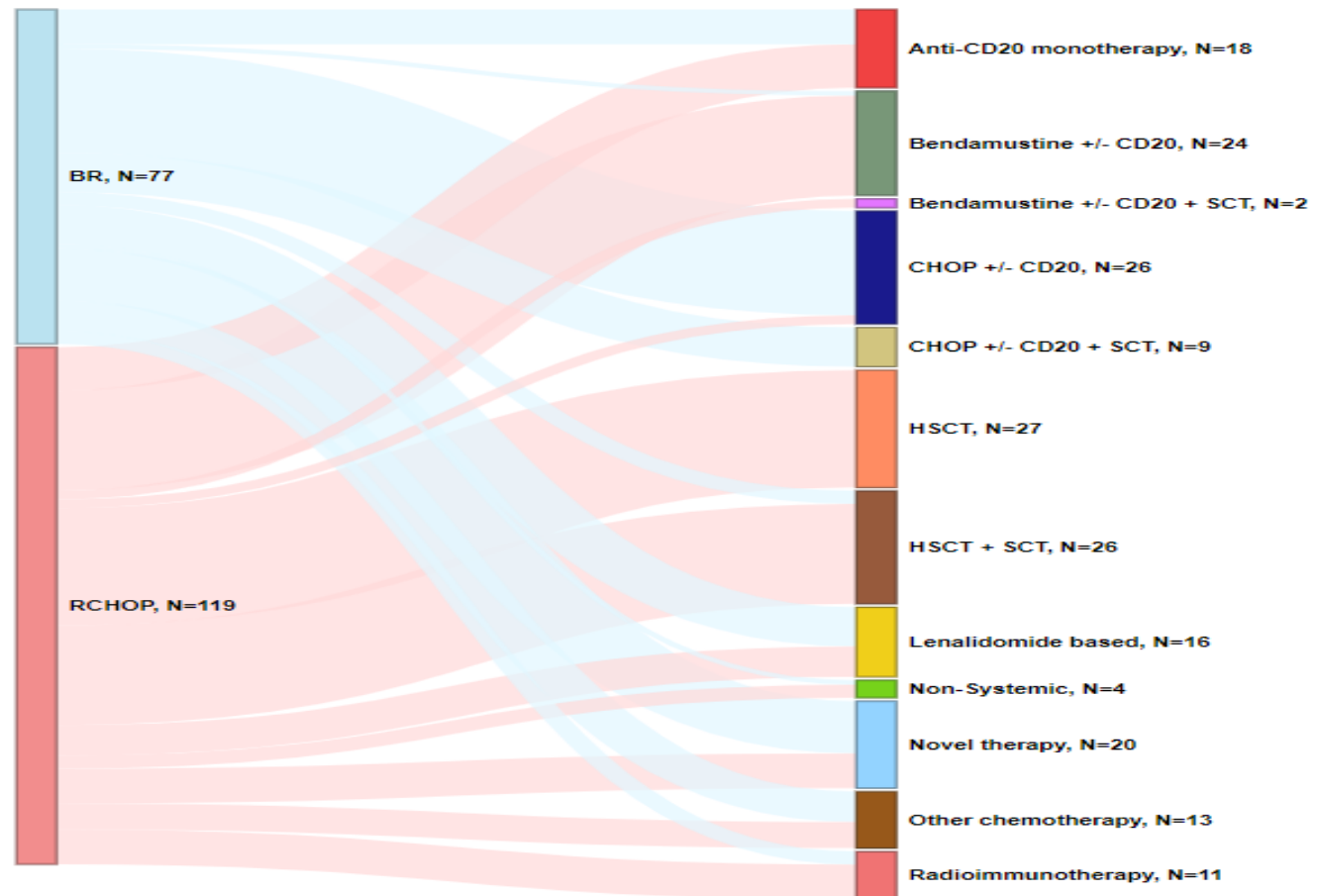
Department of Medicine,
Wilmot Cancer Institute
(C Casulo MD) and Department



Third and Later Lines of Therapy for FL (LEO CReWE)

Therapy	N	Overall response rate	Progression-free survival		Overall survival	
			2-year	HR	5-year	HR
Immunochemotherapy	133	84%	43%	1 (ref)	74%	1 (ref)
Anti-CD20 monotherapy	53	66%	47%	1.26	78%	0.88
PI3K ± anti-CD20	25	38%	25%	1.94	71%	1.38
Lenalidomide ± anti-CD20	37	55%	27%	1.72	58%	2.29
Novel therapy ± anti-CD20	39	49%	31%	1.59	72%	1.18
Salvage therapy, cellular therapy, or both	94	76%	48%	.79	75%	1.15
Other	60	67%	33%	1.43	81%	.99
Treatment on trial						
No	323	72%	40%	1 (ref)	72%	1 (ref)
Yes	98	65%	40%	1.04	83%	0.65

FL (LEO CReWE) POD24 (n=196)



FL (LEO CReWE) POD24 (n=196)

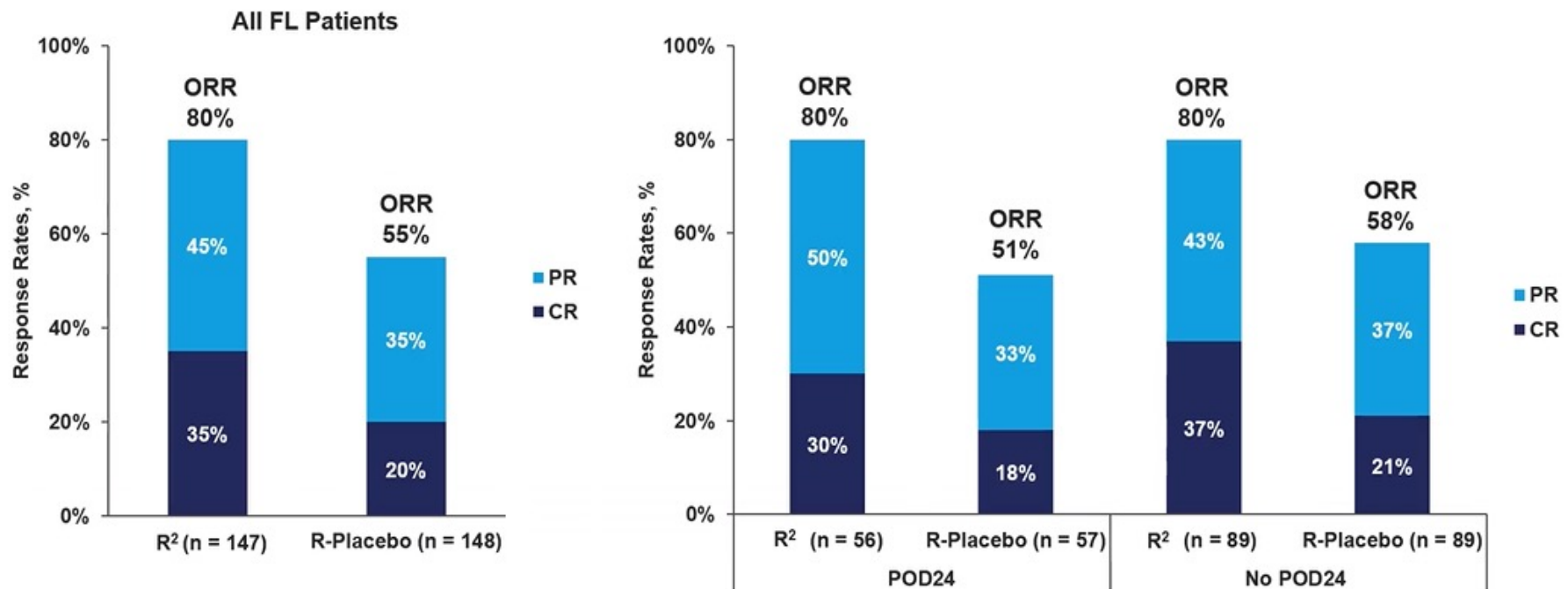
Outcomes by Treatment Group (%)	CR % (95% CI)	5 yr OS % (95% CI)
HSCT (27)	40 (27-54)	67 (56-81)
CHOP +/- CD20 (18)	29 (15-48)	66 (51-86)
Bendamustine +/- CD20 (13)	55 (32-76)	83 (71-100)
Novel therapy (10)	17 (4,42)	84 (65-100)
Anti-CD20 Monotherapy (9)	35 (15-61)	73 (53-100)
Lenalidomide based (8)	53 (27-78)	75 (53-100)
Other Chemotherapy (7)	23 (6-54)	76 (55-81)
Radioimmunotherapy (6)	30 (8-65)	46 (22-93)
Non-systemic (2)	100 (6-100)	100 (100-100)

Options for Rel/Ref Follicular Lymphoma

- Bendamustine + Obinutuzumab
- Tazemetostat
- Lenalidomide + Rituximab
- Zanubrutinib + Obinutuzumab
- CAR T cells
- Bispecific antibodies

AUGMENT: POD24 for Rel/Ref FL receiving R2 vs R-Placebo

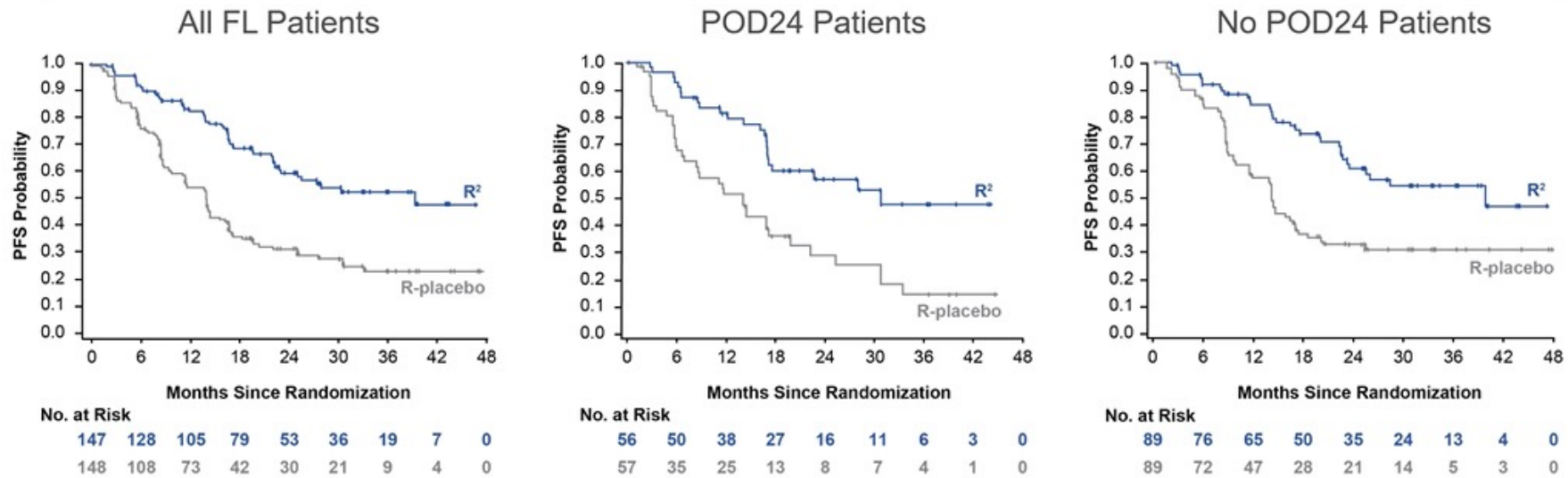
BEST RESPONSE IN ALL FL PATIENTS AND BY POD24 STATUS (ITT)



- Best responses were similar within each arm (R² or R-placebo) for all patients and those with or without POD24

AUGMENT: POD24 for Rel/Ref FL receiving R2 vs R-Placebo

PFS FOR ALL FL PATIENTS AND BY POD24 STATUS



Median PFS, mo (95% CI) (n R ² /n R-placebo)	All FL Patients (n = 147/148)	POD24 (n = 56/57)	No POD24 (n = 89/89)
R ²	39.4 (23.1-NR)	30.4 (16.8-NR)	39.4 (22.9-NR)
R-placebo	13.9 (11.2-16.0)	13.8 (6.7-16.9)	13.9 (11.2-16.6)
HR (95% CI)	0.40 (0.29-0.56)	0.41 (0.24-0.68)	0.43 (0.28-0.65)
P value	< 0.0001	0.0004	< 0.0001

Study Design

Key Eligibility Criteria

- Adults with grade 1-3a FL
- R/R disease, previously treated with ≥ 2 systemic treatments including an anti-CD20 antibody and an appropriate alkylator-based combination therapy
- Measurable disease
- ECOG PS 0-2
- Adequate organ functions
- No prior BTK inhibitor

ClinicalTrials.gov: NCT03332017

Randomization 2:1

Stratification factors

- Number of prior lines
- Rituximab refractory status
- Geographic region

Arm A
Zanubrutinib^a plus
obinutuzumab^b
N=145

Until PD/unacceptable toxicity

Arm B
Obinutuzumab^b
N=72

Option to crossover to combination if PD centrally confirmed or no response at 12 months

Primary Endpoint

- ORR assessed by ICR according to Lugano classification¹

Select Secondary Endpoints

- ORR assessed by investigator
- DOR and PFS determined by ICR and investigator assessment
- Overall survival

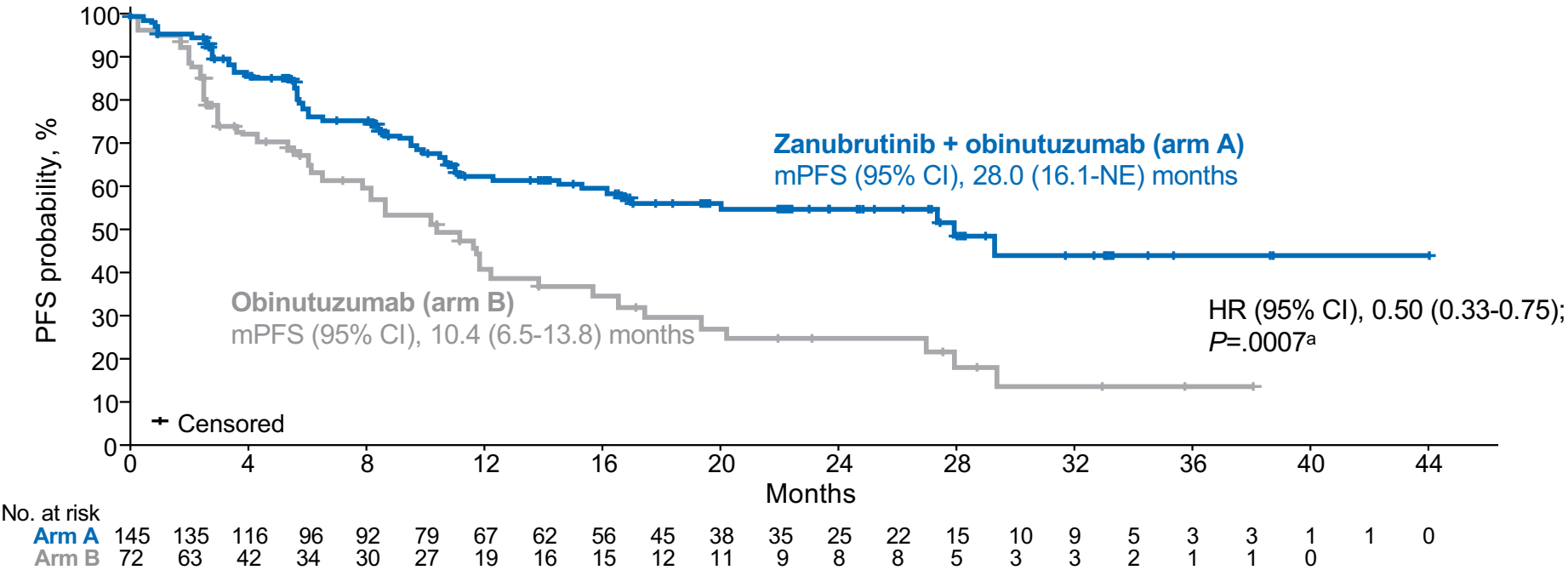
- Patients were randomized between November 2017 and June 2021
- Median study follow-up: 12.5 months

Baseline Patient Characteristics

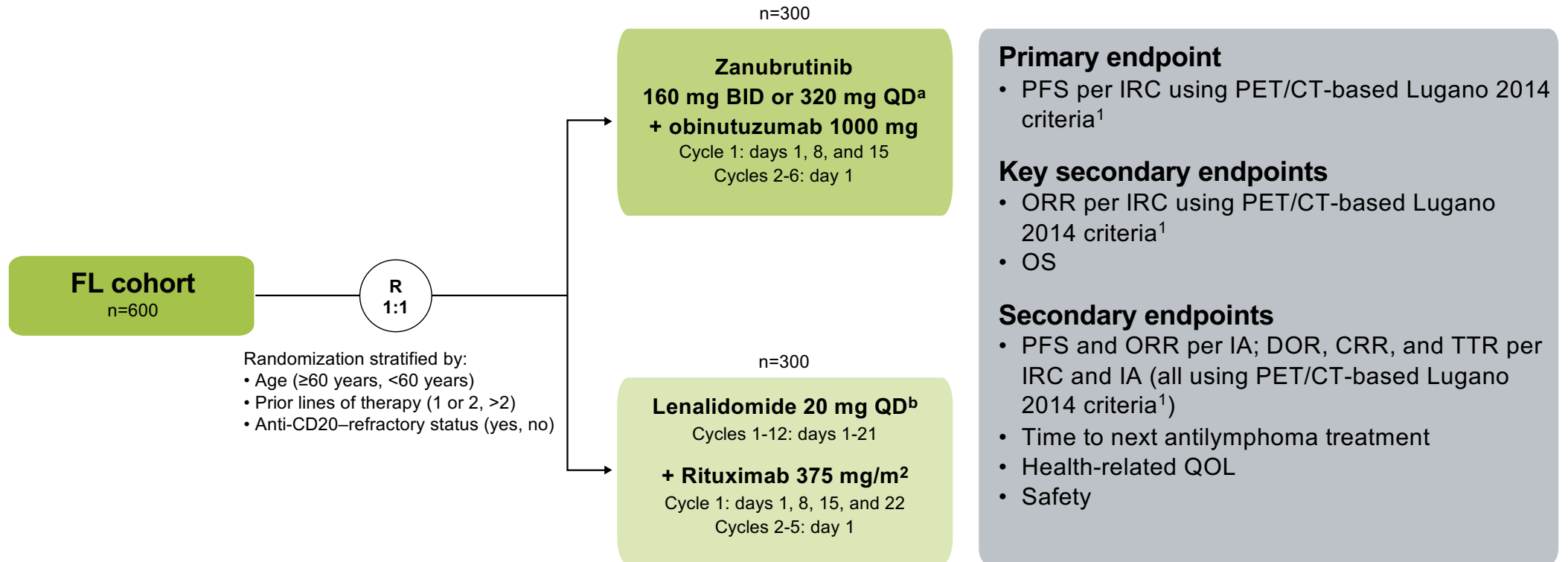
Characteristic	Zanubrutinib plus obinutuzumab N=145	Obinutuzumab N=72
Male sex, %	51.7	45.8
Median age, years (min, max)	63.0 (31, 84)	65.5 (32, 88)
FLIPI, %		
Low (0-1)	19.3	12.5
Intermediate (2)	24.8	33.3
High (≥3)	53.1	51.4
Missing	2.8	2.8
ECOG performance status ≥1, %	40.7	56.9
Bulky disease (≥5 cm), %	39.3	43.1
Elevated LDH, %	34.5	40.3
Elevated beta-2 microglobulin, %	44.8	51.4
Median prior lines of therapy, n (min, max)	3 (2, 11)	3 (2, 9)
Patients with >3 lines of therapy, %	28.3	25.0
Patients refractory to rituximab, %	53.8	50.0
Patients refractory to the most recent line of therapy, %	32.4	40.3
Patients with PD within 24 months of starting the first line of therapy, %	34.5	41.7

PFS by IRC in the Phase 2 ROSEWOOD R/R FL Trial

In the randomized phase 2 ROSEWOOD study in R/R FL (NCT03332017), zanubrutinib + obinutuzumab led to an IRC-assessed ORR of 69.0% (CR rate, 39.3%); mPFS at 24 months of 28 months



MAHOGANY: Phase 3 Study Design: FL Cohort

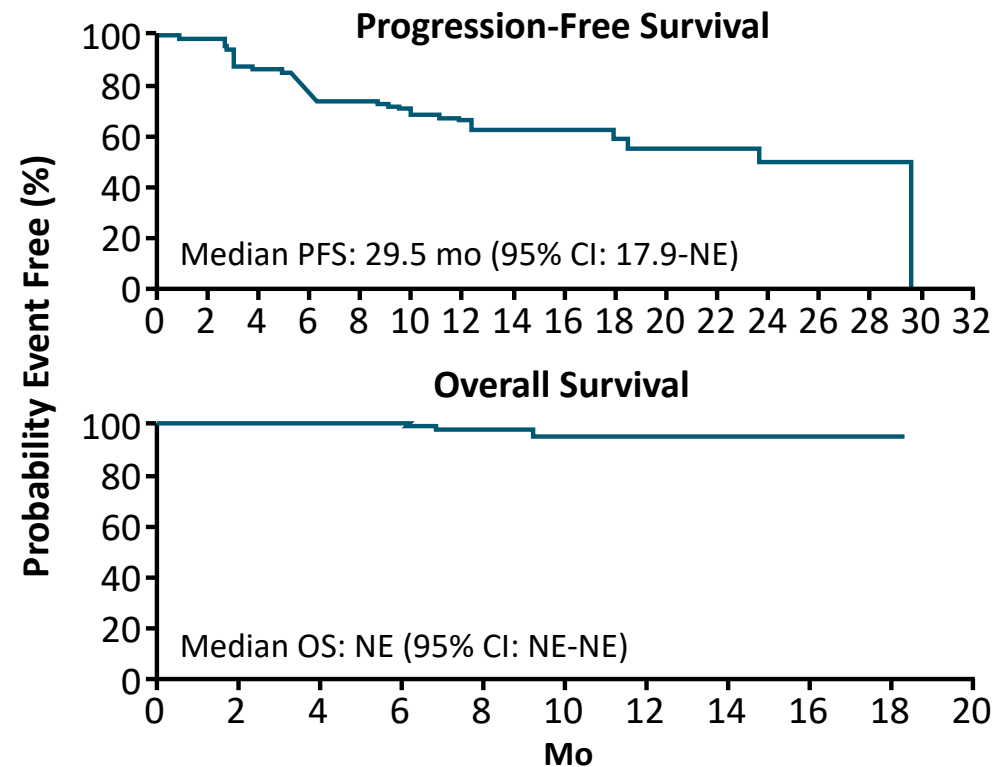


ELARA: Tisagenlecleucel for Patients With Relapsed/Refractory FL

- Single-arm phase II study of tisagenlecleucel for patients with R/R FL (N = 97)

Outcome	Evaluable Patients (n = 94)
ORR (IRC), n (%)	81 (86.2)
▪ CR	65 (69.1)
▪ PR	16 (17.0)
▪ SD	3 (3.2)
▪ PD	9 (9.6)
▪ ND	1 (1.1)
Median DoR, mo (95% CI)	NE (15.6-NE)
9-mo DoR, % (95% CI)	76.0 (64.6-84.2)

- CRS, 49% (grade ≥3, 0%); neurotoxicity, 10% (grade ≥3, 1%)

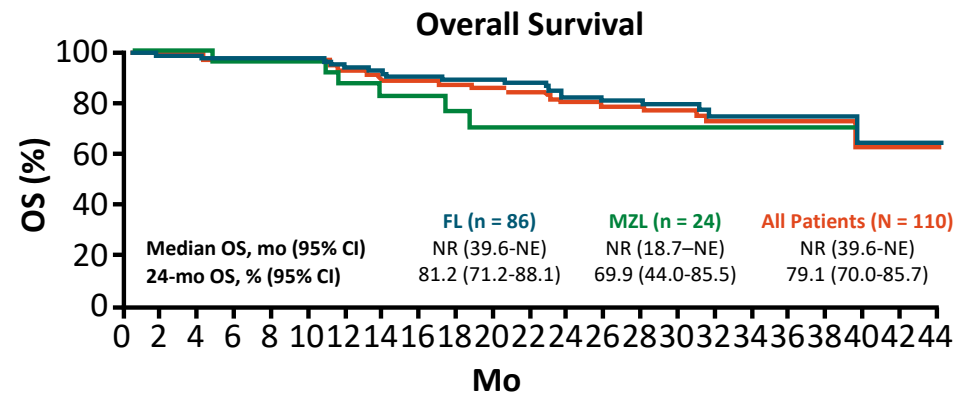
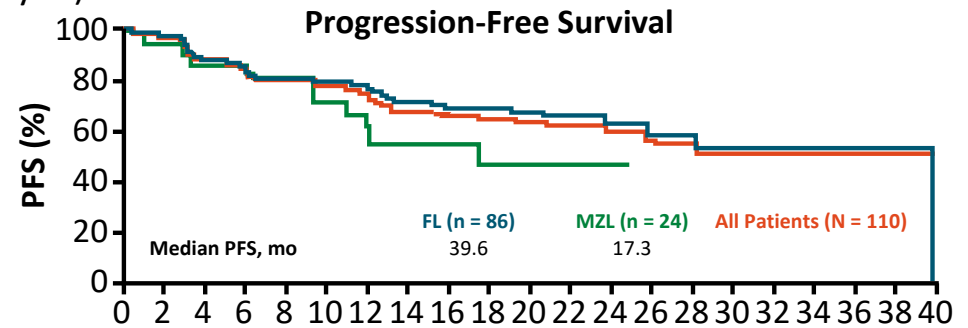


ZUMA-5: Axicabtagene Ciloleucel for Relapsed/Refractory Indolent NHL (FL or MZL)

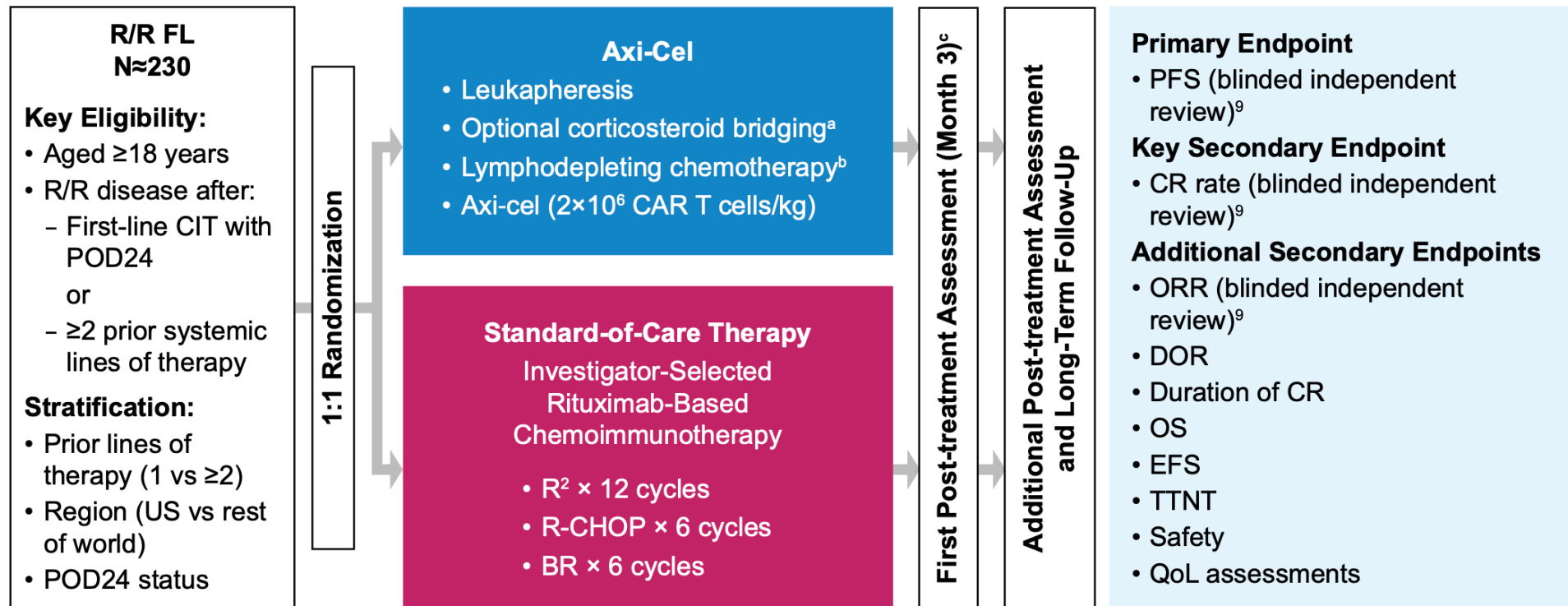
- Single-arm phase II study of axicabtagene ciloleucel for patients with R/R indolent B-cell NHL (FL or MZL) with ≥ 2 prior therapies (N = 110 eligible for efficacy analysis)

Outcome	FL (n = 86)	MZL (n = 24)	All (N = 110)
ORR, n (%)	81 (94)	20 (83)	--
▪ CR	68 (79)	15 (63)	--
▪ PR	13 (15)	5 (21)	--
▪ SD	3 (3)	0	--
▪ PD	0	1 (4)	--
▪ ND	2 (2)	3 (13)	--
Median DoR, mo (95% CI)	38.6 (24.7-NE)	NR (8.2-NE)	38.6 (24.7-NE)
24-mo DoR, % (95% CI)	66.1 (53.9-75.8)	NR (NE-NE)	63.5 (52.4-72.7)

- CRS grade ≥ 3 , 7% (6% FL); neurotoxicity grade ≥ 3 , 19% (15% FL); tocilizumab, 49%; corticosteroids, 36%



ZUMA-22: Axi-cel vs. SOC in POD24/3rd line FL



^a Bridging corticosteroid therapy will be administered at the discretion of the investigator. ^b Lymphodepleting chemotherapy will consist of cyclophosphamide (500 mg/m²/day) and fludarabine (30 mg/m²/day), received days -5 to -3 before receiving axi-cel. ^c End of Month 3 after randomization. Axi-cel, axicabtagene ciloleucel; BR, rituximab + bendamustine; CAR, chimeric antigen receptor; CIT, chemoimmunotherapy; CR, complete response; DOR, duration of response; EFS, event-free survival; FL, follicular lymphoma; ORR, overall response rate; OS, overall survival; PFS, progression-free survival; POD24, progression within 24 months from initiating first-line chemoimmunotherapy; R², rituximab + lenalidomide; R-CHOP, rituximab + cyclophosphamide, doxorubicin, vincristine, and prednisone; QoL, quality of life; R/R, relapsed/refractory; TTNT, time to next treatment; US, United States.

Bispecific Ab Mosunetuzumab in R/R FL

Phase 2 Pivotal Study

N=90

- Patients aged ≥18 yr with R/R FL grades 1-3a
- CD20+
- ECOG PS ≤1
- ≥2 prior systemic therapies including ≥1 anti-CD20 antibody and ≥1 alkylating agent

Cycle 1 (21-Day Cycles)*

Mosunetuzumab
D1: 1 mg; D8: 2 mg;
D15: 60 mg

*Cycle 1 step-up dosing for CRS mitigation.

Cycle 2

Mosunetuzumab
D1: 60 mg

Cycles 3-8

Mosunetuzumab
D1: 30 mg

Discontinue if CR by cycle 8; if PR or SD, continue treatment for 17 cycles, unless PD or unacceptable toxicity occurs

Primary endpoints

CR (best response) rate by IRF, assessed vs 14% historical control CR rate

Secondary endpoints

ORR, DoR, PFS, safety and tolerability

Outcome, % (95% CI)	By IRF (N = 90)	By INV (N = 90)
ORR	80 (70-88)	78 (68-86)
▪ CR	60 (49-70)	60 (49-70)

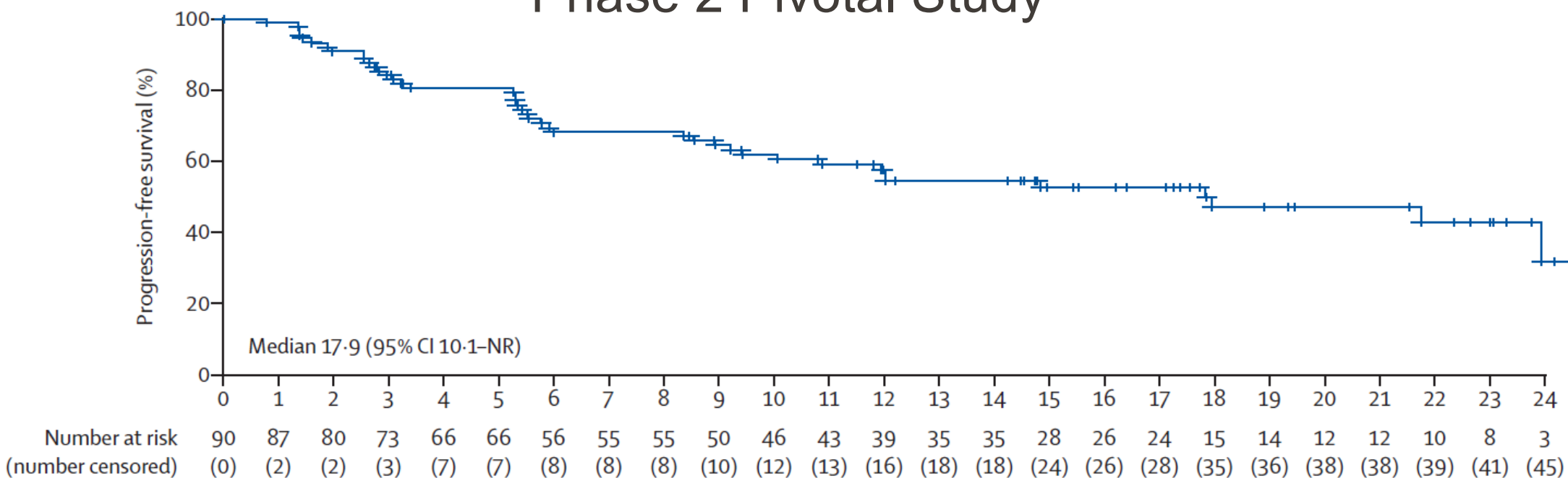
Response by Double Refractory Disease Status, % (95% CI) ¹	Yes (n = 48)	No (n = 42)
ORR	71 (56-83)	90 (77-97)
▪ CR	50 (35-65)	71 (55-84)
Response by POD ≥24 Mo of Initial Tx, % (95% CI) ¹	Yes (n = 47)	No (n = 43)
ORR	85 (72-94)	74 (59-86)
▪ CR	57 (42-72)	63 (47-77)

Budde LE et al. *Lancet Oncol.* 2022;23(8):1055-1065.

MD Anderson | Department of Lymphoma/Myeloma

Bispecific Ab Mosunetuzumab in R/R FL

Phase 2 Pivotal Study



CRS was the most common AE (40 [44%] of 90 patients) and was predominantly grade 1 (23 [26%] of 90) and grade 2 (15 [17%]), and primarily confined to cycle 1

The most common grade 3-4 AEs were neutropenia or neutrophil count decreased (24 [27%] of 90 patients), hypophosphataemia (15 [17%]), hyperglycaemia (seven [8%]), and anaemia (seven [8%]); Serious adverse events occurred in 42 (47%) of 90 patients.

**Comparison of Key Patient Characteristics in GO29781 vs LEO CReWE Cohort
(Unweighted and MAIC Weighted)**

Variable	GO29781 N=90	LEO CReWE (unweighted) N=202	Delta	Delta P-value	LEO CReWE (MAIC weighted) Weighted N=167 ESS=127	Delta	Delta P-value
Used in MAIC Matching							
Age (mean, SD)	60.0 (12.0)	60.2 (10.8)	0.2	0.85	60.3 (10.5)	0.3	0.69
Elevated LDH (%)	39%	29%	-10%	0.13	39%	0%	1.00
POD24 to 1L IC (%)	42%	43%	1%	1.00	42%	0%	1.00
Prior LOT (mean, SD)	3.3 (1.7)	2.7 (1.1)	-0.57	<0.001	3.3 (1.8)	-0.03	0.83
Double Refractory	53%	36%	-17%	0.009	53%	0%	1.00
Not used in MAIC Matching							
Male (%)	61%	58%	-3%	0.76	58%	-3%	0.68
Bulky disease (%)	18%	16%	-2%	0.73	12%	-6%	0.32
Stage III/IV (%)	77%	84%	7%	0.96	80%	4%	0.62
Prior SCT (%)	21%	13%	-8%	0.10	15%	-6%	0.32
Months since prior therapy (mean, SD)	14.2 (16.9)	18.6 (21.1)	4.4	0.004	14.8 (19.2)	0.6	0.68
MAIC=matching-adjusted indirect comparison; ESS=Effective sample size; LDH=lactate dehydrogenase; POD24=progression of disease in 24 months; 1L=first-line; IC=immunochemotherapy; LOT=line of therapy; SCT=stem cell transplant							

Primary results: Comparison of GO29781 to LEO CReWE Cohort

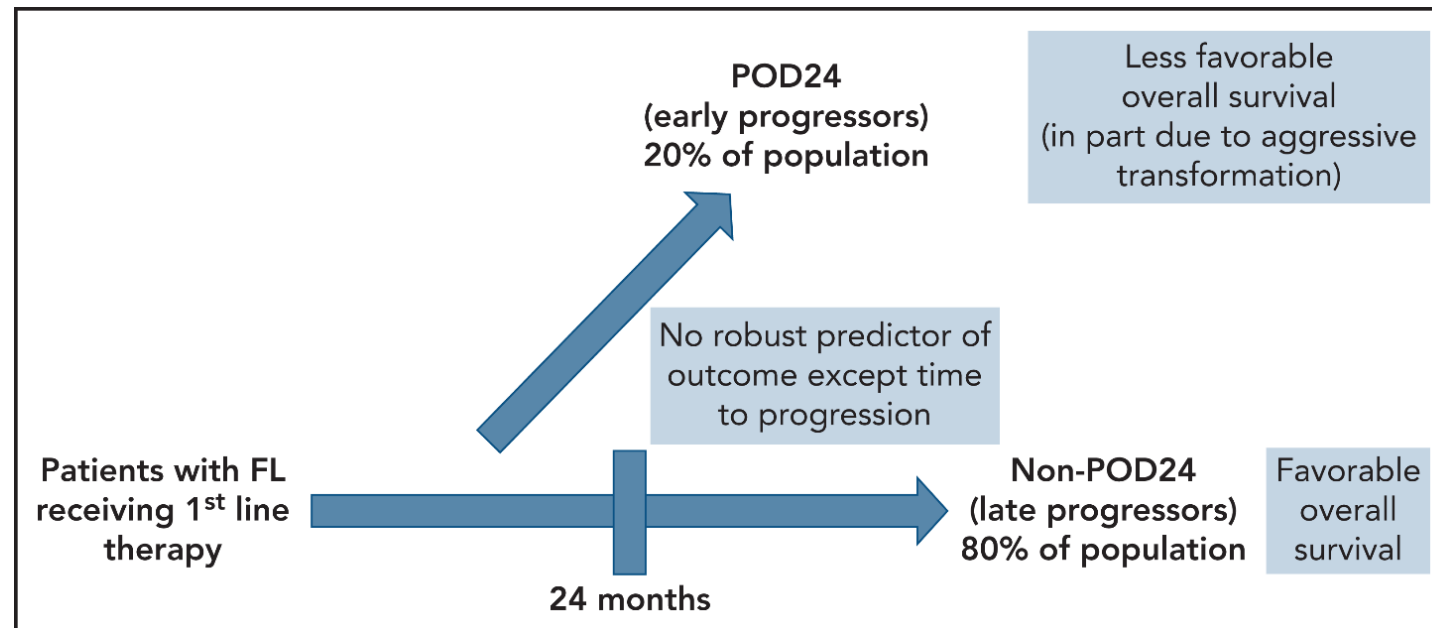
Group	N (Evaluable for Response)	ORR (95% CI)	CR Rate (95% CI)	PFS12 (95% CI)
LEO CReWE (unweighted)	202 (192)	77.6 (70.9-83.2)	57.8 (50.5-64.8)	65.0 (58.6-72.2)
LEO CReWE (MAIC Weighted)	167 (160)	73.0 (65.3-79.5)	52.9 (44.8-60.7)	59.5 (51.0-69.3)
GO29781 (trial results)	90 (90)	80.0 (70.3-87.7)	60.0 (49.1-70.2)	57.7 (46.9-68.4)
ORR=overall response rate; CR=complete response; PFS12=progression free survival at 12 months				

POD24 in follicular lymphoma: time to be “wise”

John P. Leonard

“A clever person solves a problem. A wise person avoids it.”

—ATTRIBUTED TO ALBERT EINSTEIN



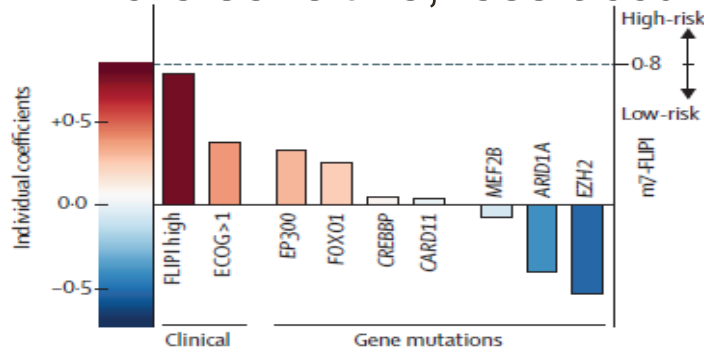
Clinicopathologic Models Identify Some Early Progressors

High risk m7-FLIPI

- 61% POD24
- 20% of patients **without** POD24 assigned high risk

POD24-PI

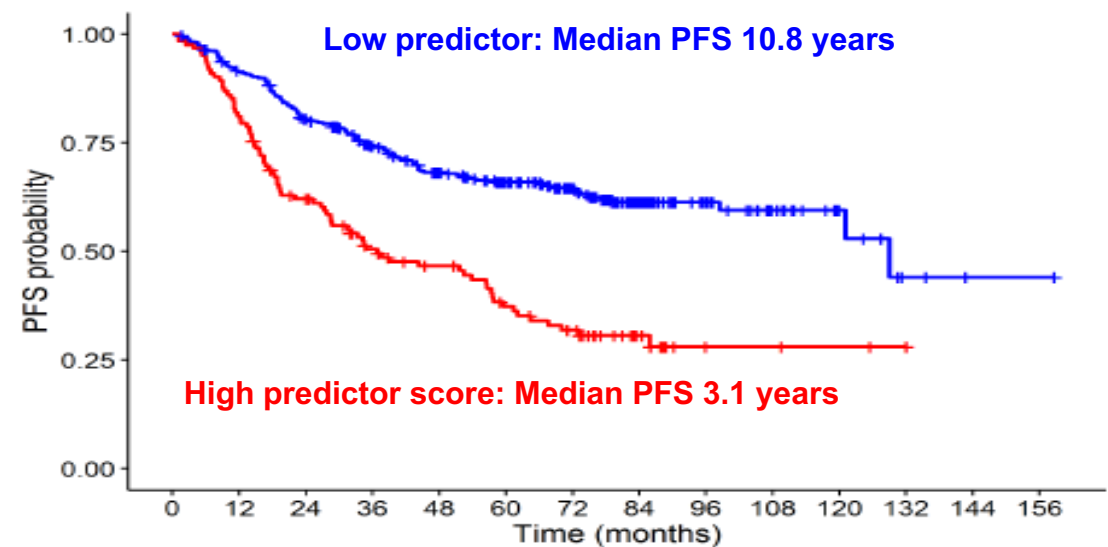
- Three m7FLIPI genes + clinical factors
- More sensitive, less accurate



Jurinovic et al. *Blood* 2016

Gene Expression Profiling

- PRIMA/Mayo/UI/Barcelona
- 23 gene signature predicts progression
- High predictor score, centroblast signature worse, enriched POD24



Huet et al, *Lancet Oncology* 2018

1L FL What's next? – FLIPI24

Aim: Develop a FL clinical prognostic index using early events as the primary endpoint

Harmonized individual pt data from >9,000 pts with FL from 11 international registries

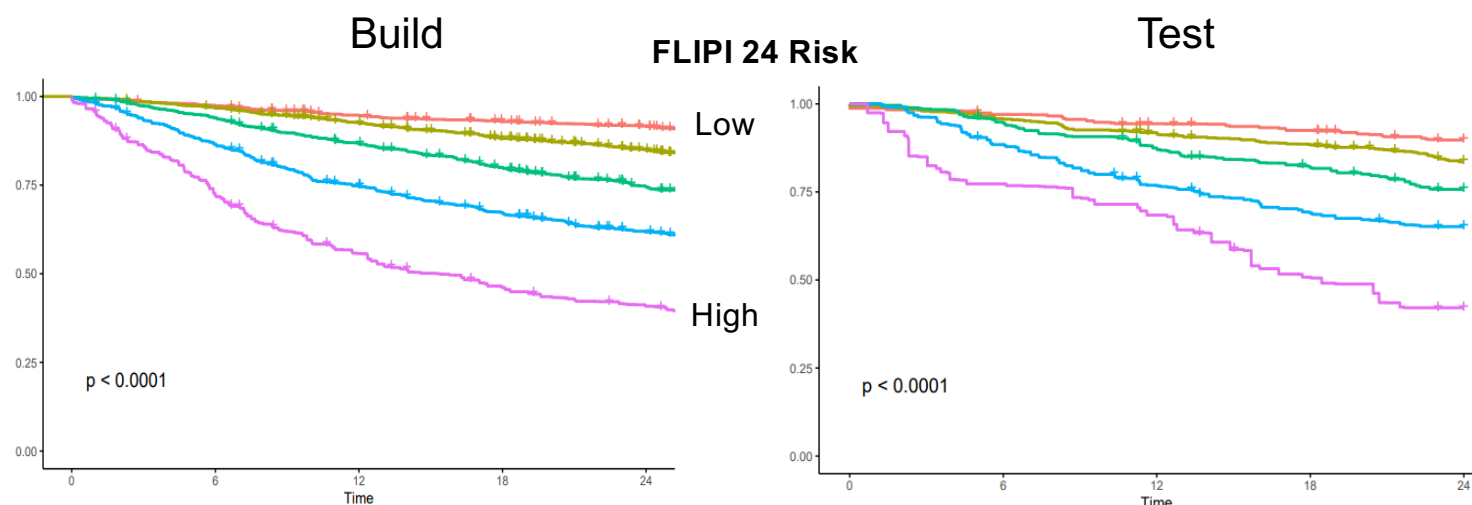
4743 1L FL pts Dx 2002-2018; vtreated with R-CHOP, B-R, R-CVP

- Model build on 80% (N=3793)
- Testing on 20% (N=950)

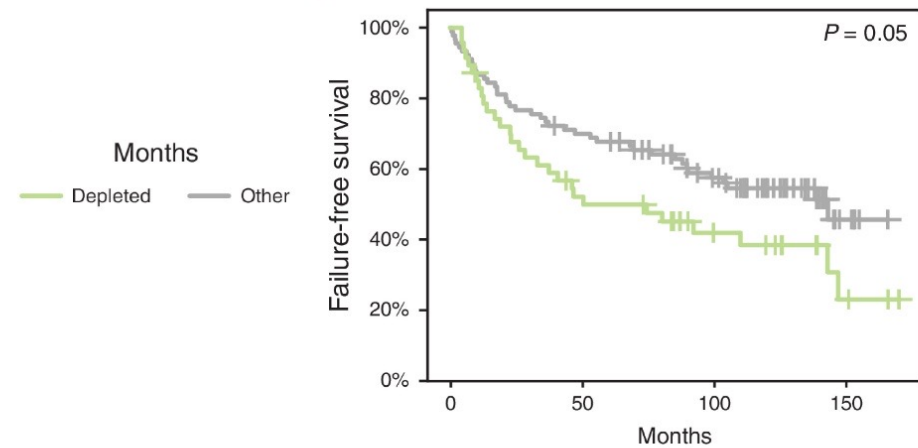
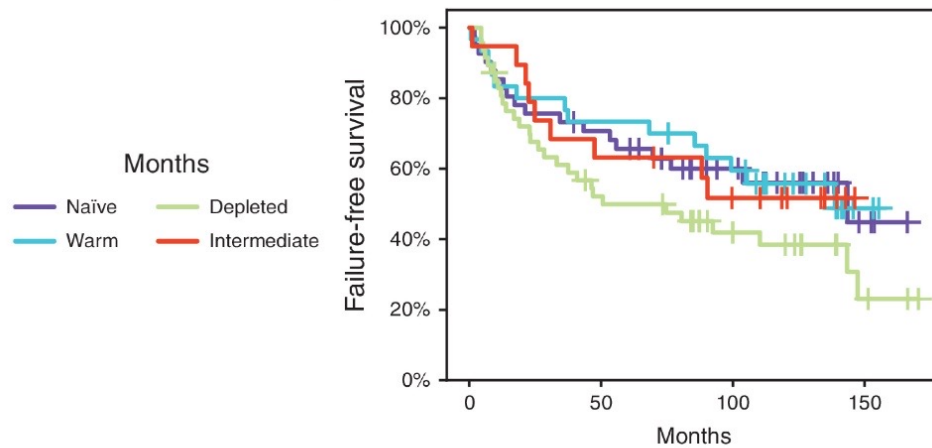
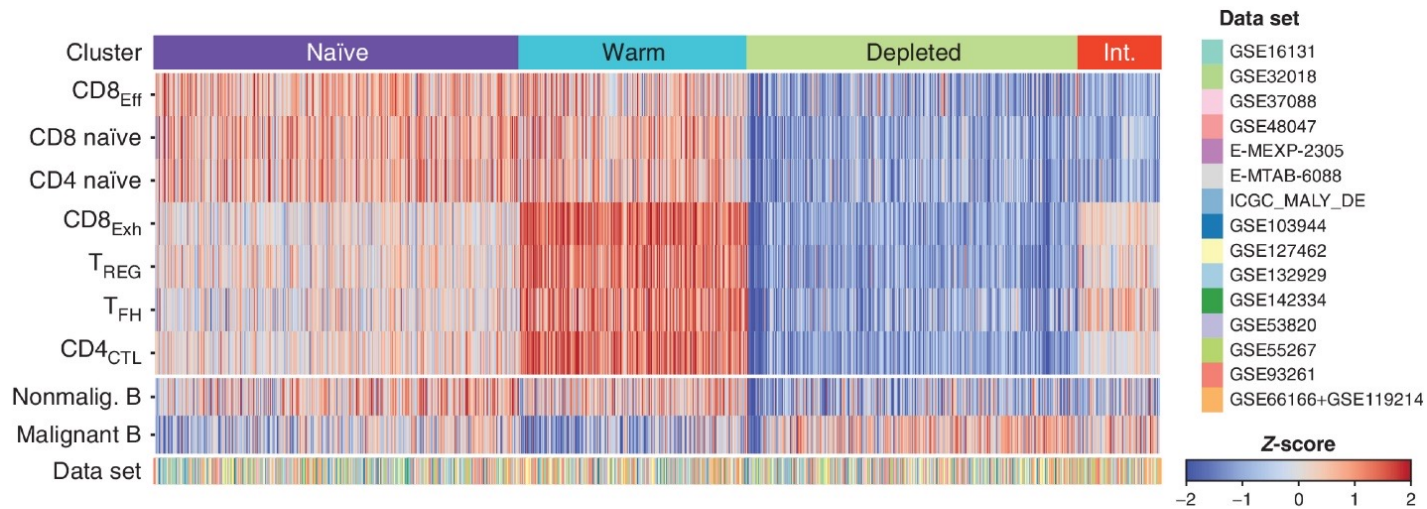
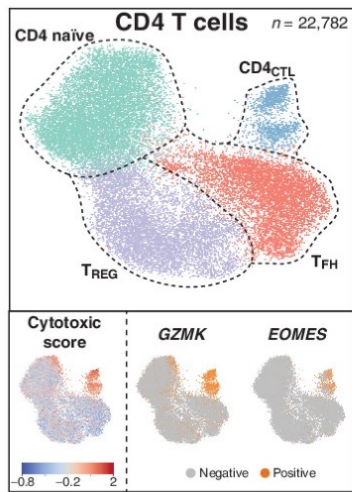
EFS Across Models

Final Model

Variable	Input Range	Effect
Age	18-90	Linear 60-90 Inflection at age 75
LDH/ULN	0.5-5	Linear
B2M	1-10	Linear
HGB	8-17	Linear
WBC	4-11	Linear

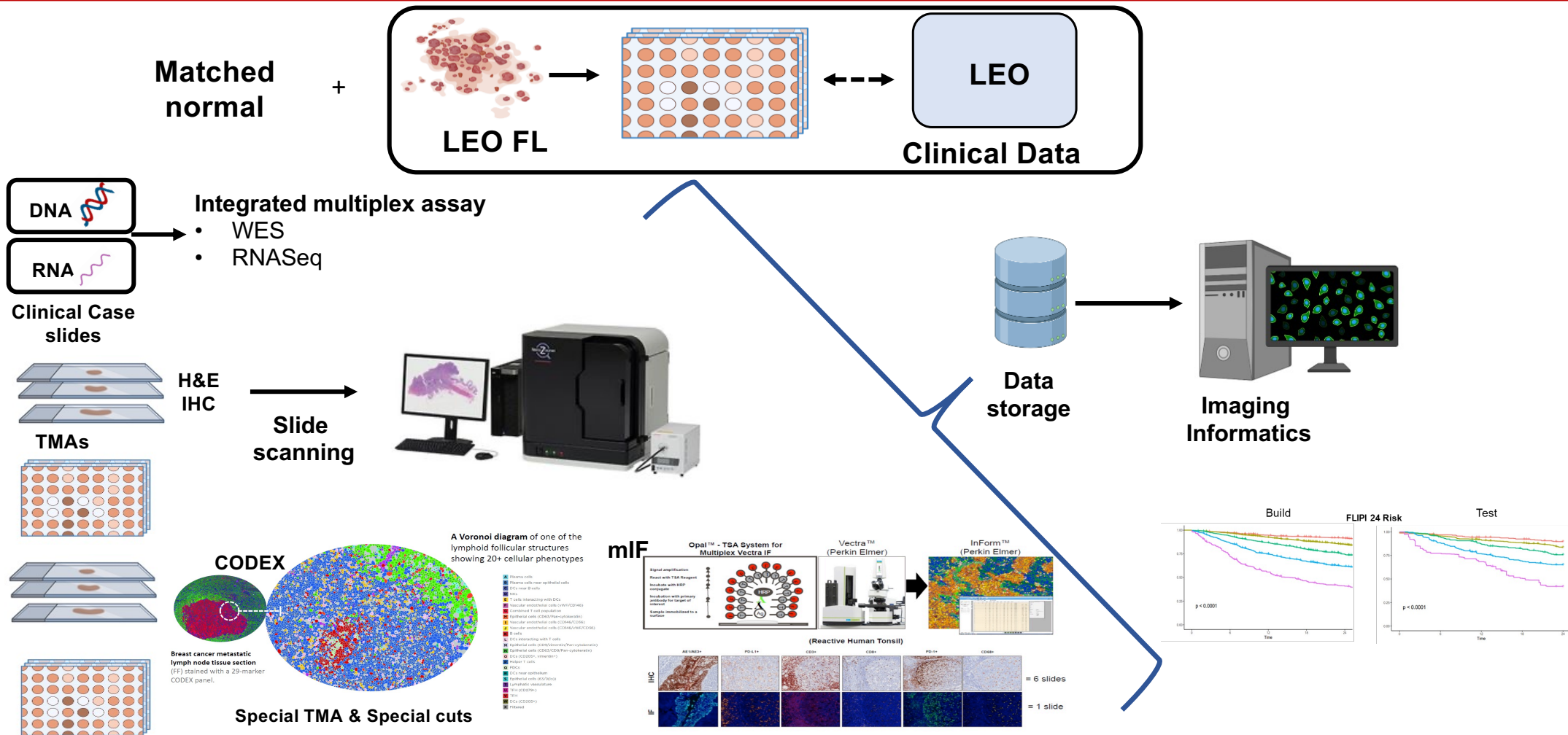


scRNASeq defines micrmoenvironment signature with distinct outcomes



LEO Data/Tissue Repository Workflow

IRB Protocol: Clinical and Epidemiological Studies of Lymphoma



Conclusions

Many options for Early POD

Is there a role for BTK inhibitors?

- Would not use ibrutinib in R/R FL
- Zanubrutinib + Obinutuzumab recent FDA approval; awaiting MAHOGANY

Understanding patterns of failure

- When will we have a new frontline approach?
 - Risk stratified therapy
 - Randomized Trials
 - Biomarker directed therapy

Thank you!

Aggressive Lymphomas Westin (Section Head)	Aggressive Lymphomas Nastoupil (Section Head)
Fayad Nair Neelapu Al Zaki	Chihara Flowers Nze Strati Rodriguez
Rare Lymphomas Wang (Section Head)	Basic/Translational Lymphoma Green (Section Head)
Ahmed Jain Malpica Parmar Hun Lee Iyer	<i>Green Lab:</i> Yang; Li; Yu Liu <i>Wang Lab:</i> Jiang; Yao; Nie; Heng-Huan Lee; Ying-Nai Wang; Yang Liu; Wei Wang <i>Flowers Lab:</i> Balakrishnan; Davis; Hildebrandt



CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS
Lymphoma Epidemiology of Outcomes



**Informatics Tools for Quantitative Digital Pathology
 Profiling and Integrated Prognostic Modeling (U01 CA220401)**





Questions?

THE UNIVERSITY OF TEXAS

MD Anderson
Cancer Center

Making Cancer History®

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Division Head
Chair, Professor

Division of Cancer Medicine
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Question 1

62 year old man with FL initially treated R-CHOP (at age 60) then experienced progression in 1.5 years and he is now experiencing persistent fevers and pain at the site of an enlarged left neck LN 4.5 cm and abdominal discomfort.

- Noted to have multiple enlarged LN with the largest being a 5.7 x 6.9 cm conglomerate mesenteric mass.
- PET/CT showed SUV_{max} 7.
- LDH normal. Hgb 9.6 Plts Normal
- Biopsy shows FL

What management strategy would you consider next?

- A. Rituximab
- B. Ibrutinib
- C. R-dose adjusted EPOCH
- D. R-GemOx followed by Autologous transplantation

Question 2

Which of the following is a clinical trial focused on patients with FL with POD24?

- A. ROSEWOOD
- B. MAHOGANY
- C. ZUMA-5
- D. ZUMA-22
- E. SWOG S0016