

Ublituximab

Nathan Fowler MD

Lead, New Drug Development

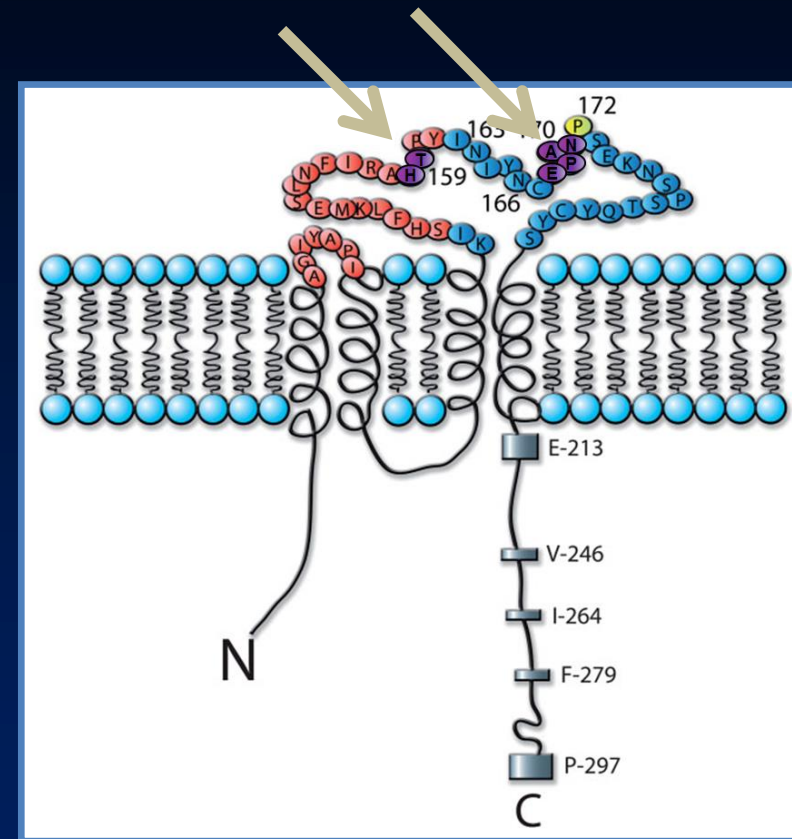
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Ublituximab (TG-1101)

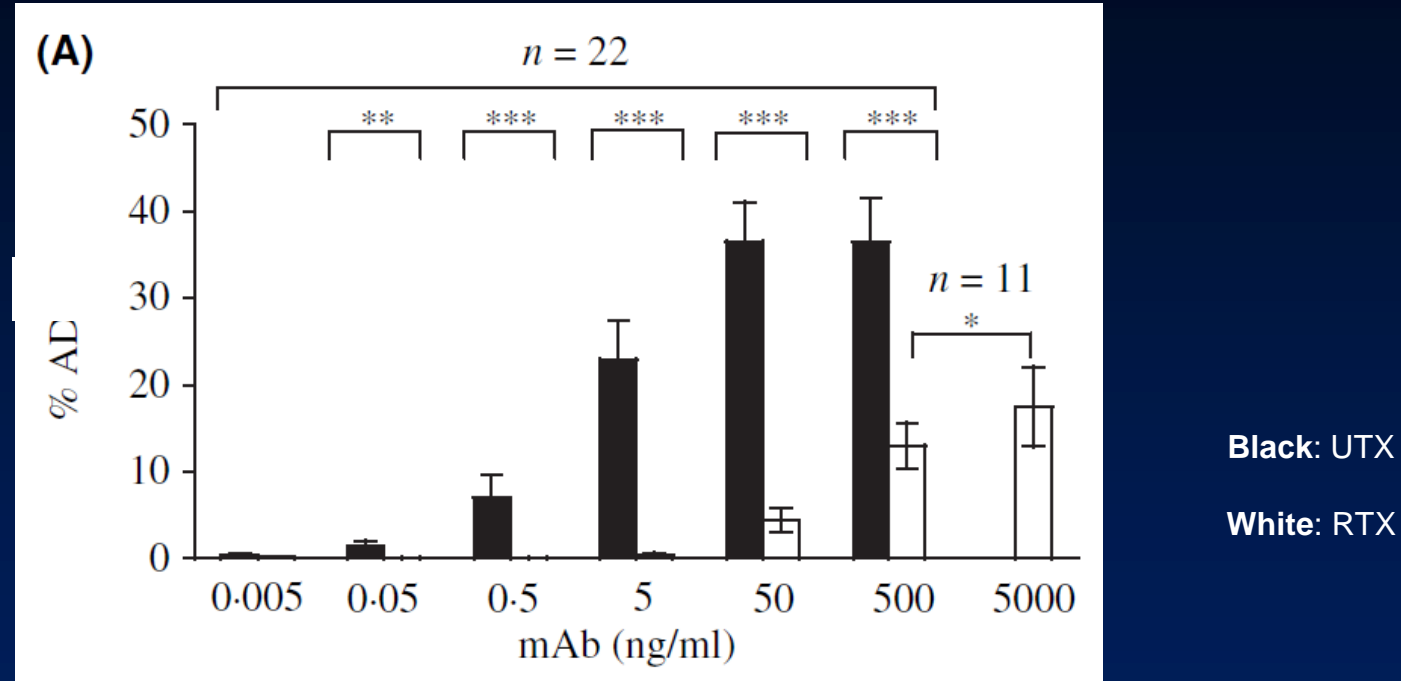
- Type 1 chimeric IgG1 mAb
- Unique binding sequence on CD20
Potential advantages over current standards of care:
 - Glycoengineered for enhanced ADCC
 - Activity in “low” CD20 expressing cell lines
- Single agent responses observed in rituximab refractory patients¹



Source: Adapted from Ruuls et al 2008

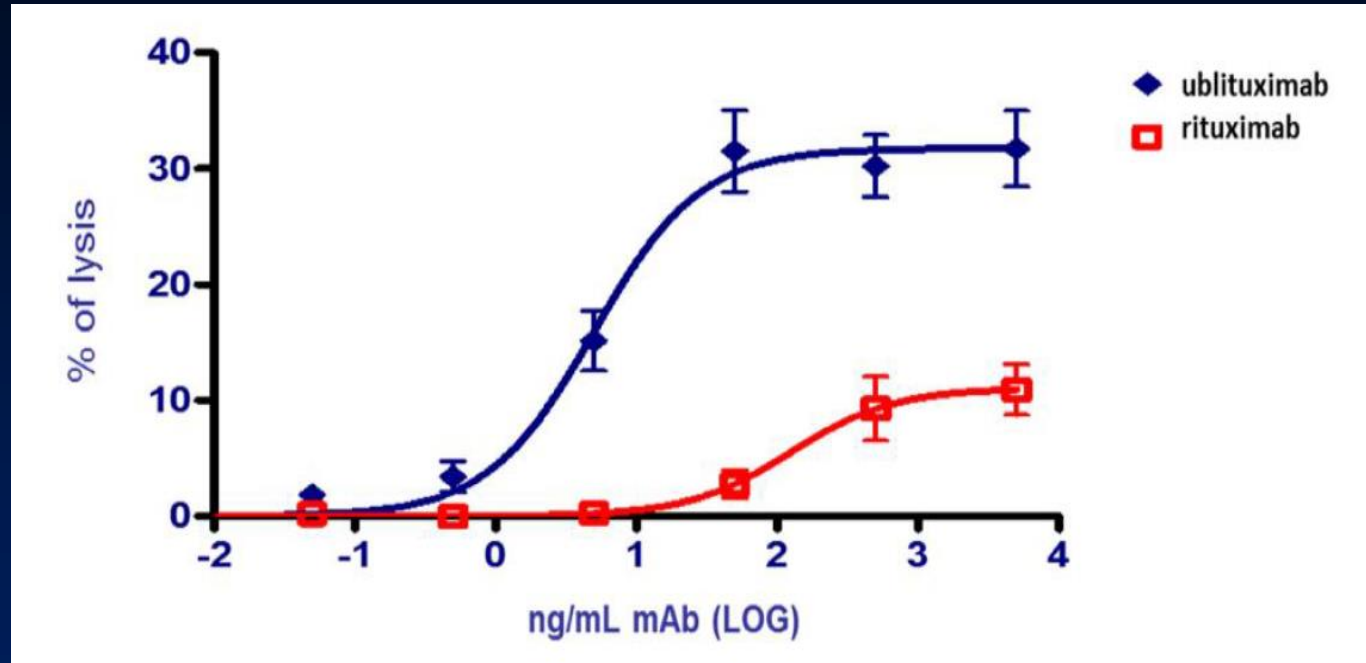
ADCC

Ublituximab vs Rituximab



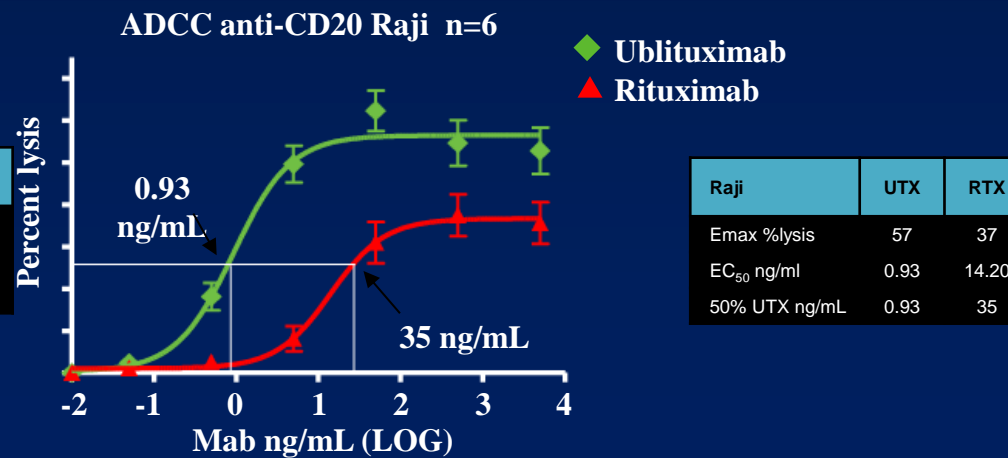
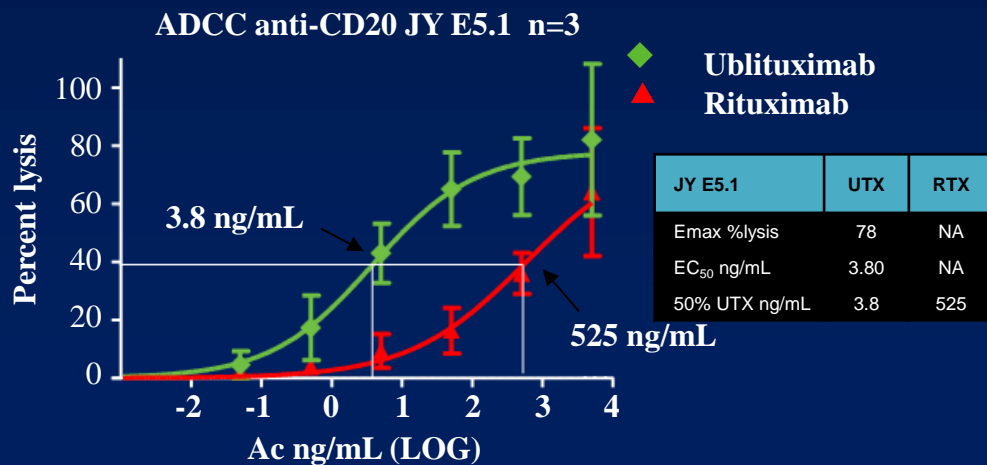
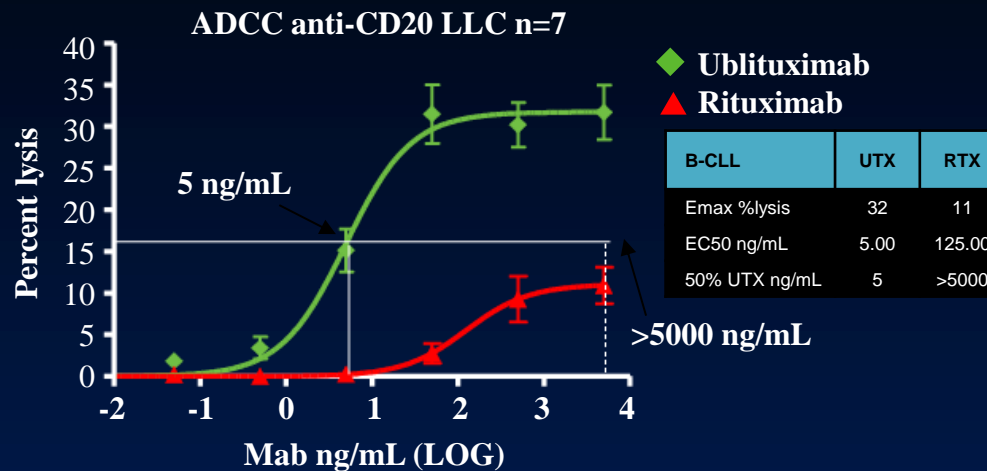
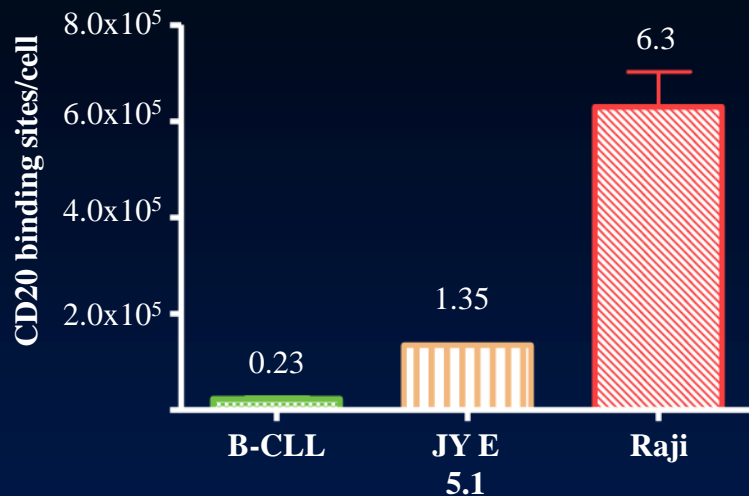
- Rituximab (RTX) vs. Ublituximab (UTX) ability to induce ADCC in CLL patient donor cell lines

Enhanced ADCC Activity in Lysis Assays



- Lysis of patient-derived CLL cells were tested in the presence of healthy donor NK cells at different concentrations of either UTX or RTX

Superior ADCC Induction Irrespective of CD20 Expression Levels



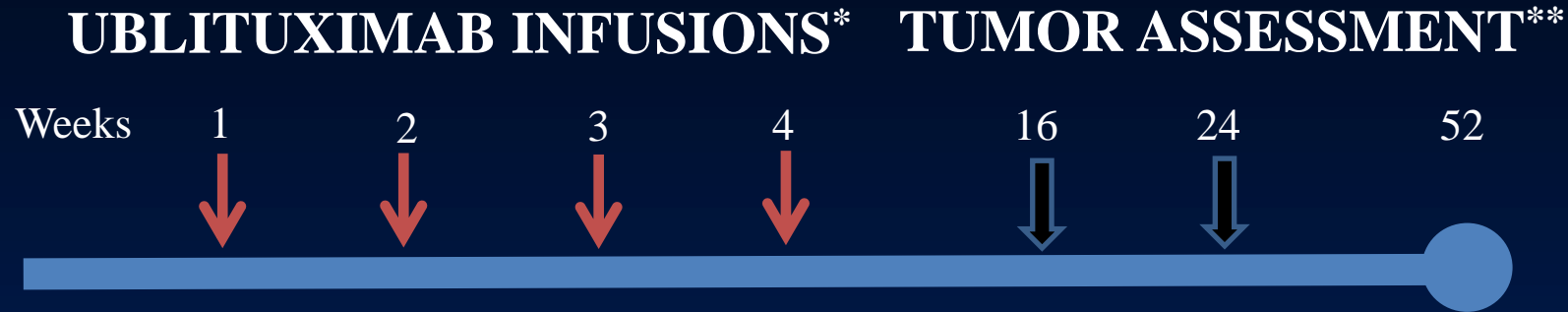
A Phase 1 Study of LFB-R603, A Novel Anti-CD20 Antibody, In Patients with Relapsed Chronic Lymphocytic Leukemia (CLL)

Guillaume Cartron¹, Bruno Cazin², Bertrand Coiffier³, Stephane Lepretre⁴, Pierre Feugier⁵, Therese Aurran⁶, Guylene Chartier⁷, Alain Sadoun⁷, Vincent Ribrag⁸

¹Hôpital Saint Eloi, Montpellier, France; ²Hôpital C. Huriez, Lille, France; ³Centre Hospitalier Lyon-Sud, Pierre-Benite, Lyon, France; ⁴Centre Henri Becquerel, Rouen, France; ⁵Hôpital Brabois, Vandoeuvre Les Nancy, France; ⁶Institut Paoli-Calmettes, Marseille, France; ⁷LFB Biotechnologies, Les Ulis, France; ⁸Institut Gustave Roussy, Villejuif, France

Presented at the 52nd Annual American Society of Hematology Meeting; Orlando, FL; December 2010. Abstract 2447.

Ublituximab Phase 1 Trial in CLL: Treatment Schedule



*Doses of UTX ranged from 5 – 450 mg. There were 5 sequential cohorts (standard 3+3). The total dose per cohort was: (A) 75 mg; (B) 200 mg; (C) 510 mg; (D) 1050 mg; (E) 1650 mg.

- Key inclusion criteria
 - Relapsed or refractory CLL, after ≥ 1 prior course of fludarabine
 - Circulating lymphocytes expressing CD20, CD5-CD19 and CD23
- Key exclusion criteria
 - Prior treatment with an anti-CD20 monoclonal antibody < 6 months before enrolment
- Primary objectives: safety

Ublituximab Monotherapy in CLL: Baseline Characteristics

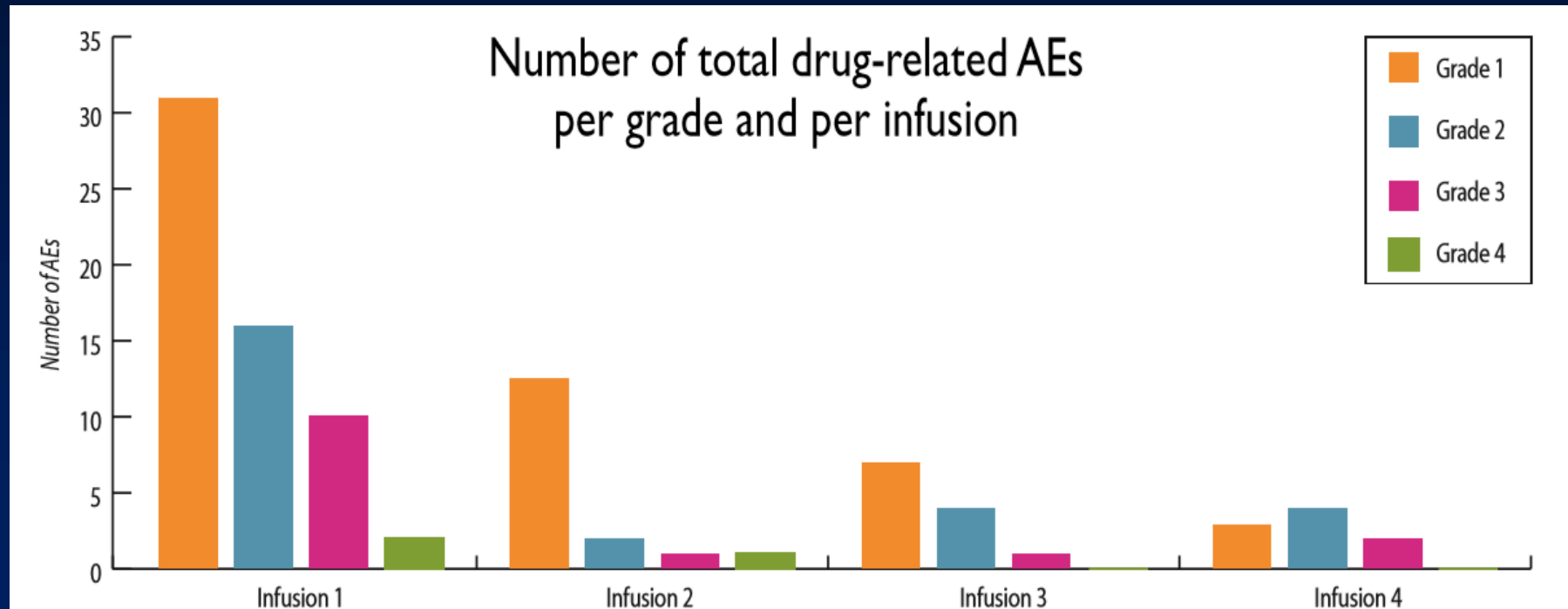
Median age, years (range)	62 (43 – 76)	
Male/Female, n	17/4	
ECOG PS 0/1, n	12/9	
Prior therapy regimens, median (range)	3 (1 – 6)	
Time from diagnosis to inclusion, years (range)	8.33 (2.5-14)	
Disease status at inclusion, relapsed/refractory, n	20/1	
Response to last anticancer regimen, n	CR, 7; PR, 10; NR, 3, UNK, 1	
Prior exposure to rituximab, %	57	
FISH results, n	Normal	9
	11q-	7
	13q-	9
	17p-	3
Lymph node enlargement, %	100	
Bulky adenopathy (>5cm), %	38	
SDP, mm ³ (range)	3427 (182-22164)	

Ublituximab Monotherapy in CLL: Treatment-related Toxicity

Treatment-related AE	All Grades		Grade 3/4	
	N	%	N	%
TOTAL	113	100	23	61.9
Pyrexia	18	61.9	0	NA
Infusion related reaction*	12	52.4	3	14.3
Infection	12	28.6	5	14.3
Headache	11	33.3	0	NA
Neutropenia	10	38.1	7	28.6
Chills	6	23.8	0	NA
Thrombocytopenia	6	23.8	1	4.8
Hepatic cytolysis	4	19	3	14.3
Nausea	4	14.3	0	NA
Abdominal pain	3	9.5	0	NA
Asthenia	2	9.5	0	NA
Pancytopenia	2	9.5	2	9.5
Anemia	2	9.5	0	NA
Gamma glutamyltransferase increase	2	9.5	0	NA
Anal abscess	2	4.8	0	NA

Ublituximab Monotherapy in CLL: Infusion Reactions

- All patients received 4 infusions
- 34% of the total AEs occurred after the first infusion
- 41% of the total AEs occurred <48 hours after the ublituximab infusion



Ublituximab Monotherapy in CLL: NCI-WG Responses

Cohort, n	A	B	C	D	E	TOTAL
Patients: Evaluable	6:5	3:2	3:3	3:3	6:5	21:18
CR	0	0	0	0	0	0
PR at week 16	1	2	1	0	1	5
PR at week 24	1	0	1	0	1	3
SD/PD	2/2	0/0	2/0	1/2	2/2	7/6

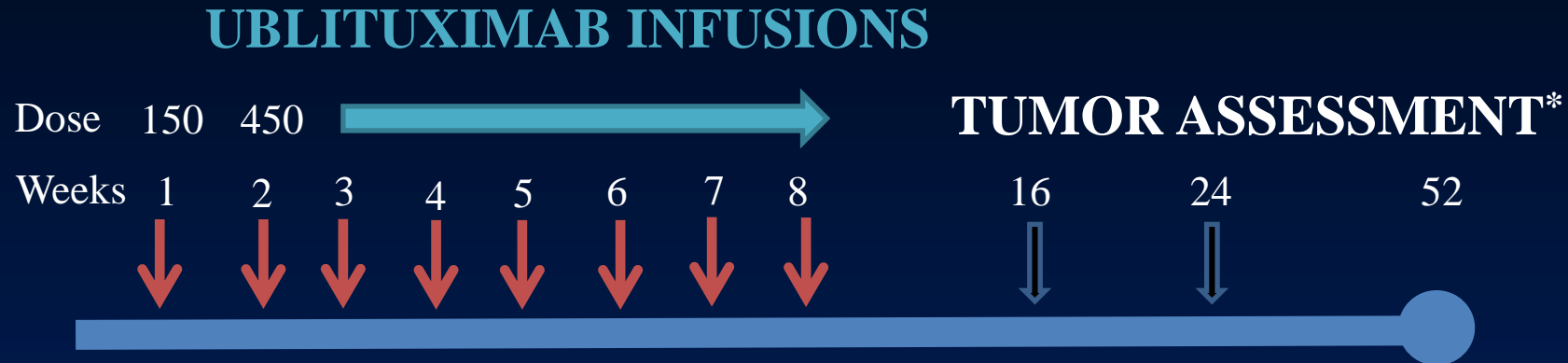
Final Results of A Multicenter Phase 1b Single Agent Study With The Novel Anti-CD20 Monoclonal Antibody Ublituximab (TG-1101) In Patients With Relapsed Chronic Lymphocytic Leukemia (CLL)

Bruno Cazin¹, Stéphane Leprêtre², Bertrand Coiffier³, Thérèse Aurran⁴, Guillaume Cartron⁵, Pierre Feugier⁶, Oana Brehar², Alain Sadoun⁷, Peter Sportelli⁸, Hari Miskin⁸, and Vincent Ribrag⁹

Presented at the 18th Congress of the European Hematology Association (EHA); Stockholm, Sweden; June 2013.
Abstract P111.

Also presented at the 53rd ASH Annual Meeting and Exposition, December 10-13, 2011. Abstract 2862.

Ublituximab Phase 1 Trial in CLL: Treatment Schedule



*Response assessment was conducted at Week 16, with a confirmatory assessment conducted at Week 24 for responders.

- Primary objectives: safety
- Secondary objectives: PK, immunogenicity, descriptive statistics of laboratory values, efficacy
- Exploratory: biomarkers, correlation of FC γ RIIIA polymorphisms to response

Ublituximab Monotherapy in Relapsed CLL: Demographics

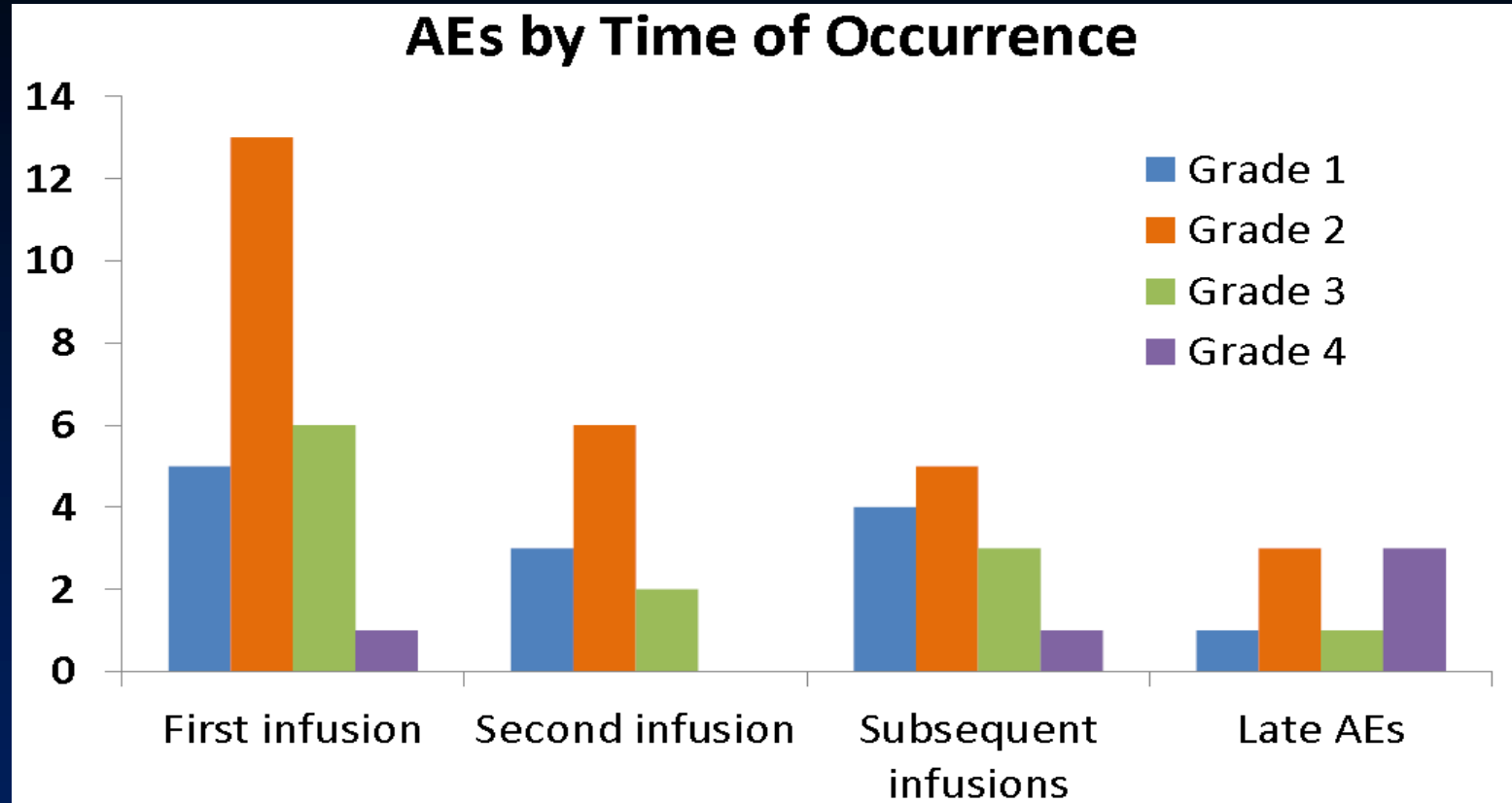
Median age, years (range)	69.5 (62 – 77)	
Male/Female, n	10/2	
ECOG PS 0/1, n	6/6	
Prior therapy regimens, median (range)	3 (1 – 8)	
Time from diagnosis to inclusion, years (range)	10.4 (4-23.6)	
Response to last anticancer regimen, n	CR, 3; PR, 6; SD, 2, PD, 1	
Prior exposure to rituximab, %	58	
FISH results, n	Normal	0
	11q-	2
	13q-	4
	17p-	2
	Trisomy 12	4
Bulky adenopathy (>5cm), %	33	
FCγRIIIA polymorphism, n	F/F	5
	F/V	4
	V/V	3

Ublituximab Monotherapy in Relapsed CLL: Treatment-related Toxicity

Treatment-related AE	All Grades		Grade 3/4	
	N	n (%)	N	n (%)
Any drug-related AEs	57	12 (100)	17	10 (83.3)
Infusion related reaction*	11	9 (75)	4	4 (33.3)
Neutropenia	10	7 (58.3)	9	7 (58.3)
Pyrexia	6	6 (50)		
Thrombocytopenia	5	5 (41.7)		
Chills	2	2 (16.7)		
Increased AST/ALT	2	2 (16.7)	2	2 (16.7)
Asthenia	2	2 (16.7)		
Headache	2	1 (8.3)		
Febrile neutropenia	1	1 (8.3)	1	1 (8.3)
Pancytopenia	1	1 (8.3)	1	1 (8.3)
Bronchitis	1	1 (8.3)		
Herpes zoster	1	1 (8.3)		
Infection (non specified)	1	1 (8.3)		
Other	12	7 (58.3)		

- 11 patients received all 8 infusions without dose reduction
- No drug-related mortality, and no on-study deaths

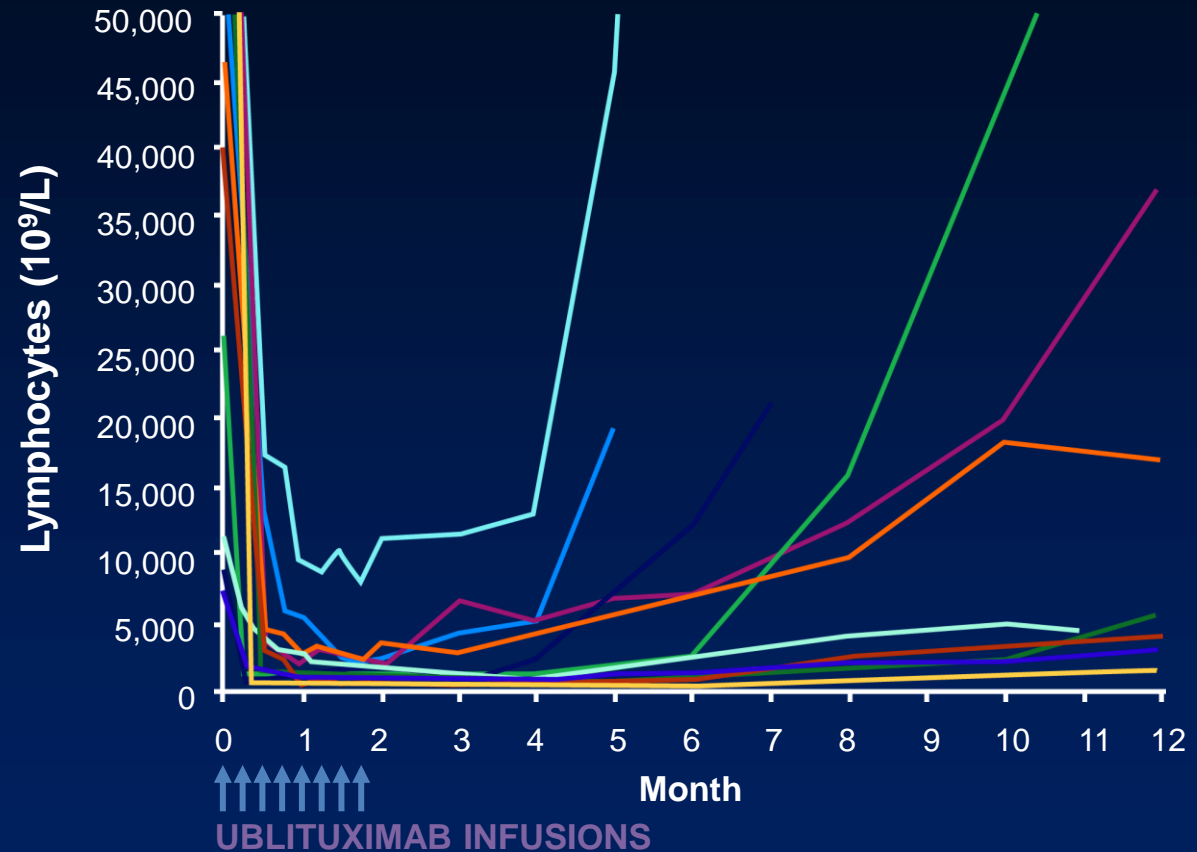
Ublituximab Monotherapy in Relapsed CLL: Infusion Related Reactions



- Fever, chills, arterial hypotension, and tachycardia most common manifestations
- All recovered without sequelae through infusion rate management and/or symptomatic treatment with or without corticosteroids

Ublituximab Monotherapy in Relapsed CLL: Efficacy Results

Patients	12
Evaluable	11
CR	0
PR at Month 4 (week 16)	7 (63.6%)
SD at Month 4 (week 16)	4
PD at Month 4 (week 16)	0
PR at Month 6 (week 24)	5 (45.5%)

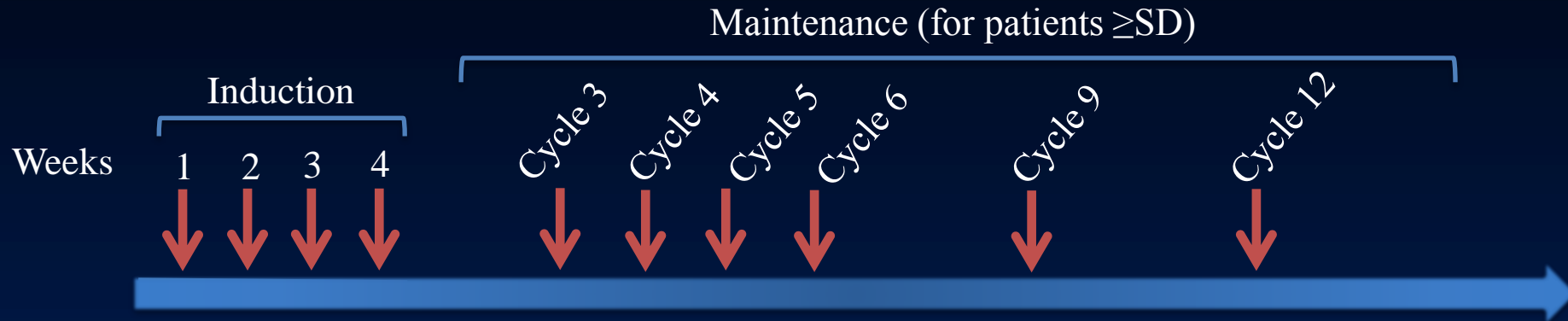


A Phase I Trial of Ublituximab (TG-1101), A Novel Anti-CD20 mAb in B-Cell Lymphoma Patients with Prior Exposure to Rituximab

Owen A. O'Connor¹, Changchun Deng¹, Jennifer E. Amengual¹, Mazen Y. Khalil², Marshall T. Schreeder³, Daruka Mahadevan⁴, Petros Nikolinakos⁵, Ahmed Sawas¹, Jasmine M. Zain¹, Molly Patterson¹, Amber Moon², Kathy Cutter³, Emily K. Pauli³, Marnie Brotherton⁴, Jamie Hodgson⁵, Christen N. Cooper⁵, Michelle A. Mackenzie⁶, Peter Sportelli⁷, Hari P. Miskin⁷, and Charles M. Farber⁶

Presented at the 19th Congress of the European Hematology Association (EHA); Milan, Italy; June 2014. Abstract 444.

Ublituximab in RR B-Cell Malignancies: Treatment Schedule



Induction: UTX administered weekly x 4 in Cycle 1 (Cycle 28 days)

Maintenance: monthly infusions for patients with \geq SD starting Cycle 3; and infusions every 3 months starting Cycle 6

- Primary objective: Safety and MTD
- Secondary objectives: ORR (CR+PR), PK, and PFS
- Phase 1 cohort design: 3 + 3 dose escalation

Cohort 1	Cohort 2	Cohort 3	Cohort 4
450 mg	600 mg	900 mg	1200 mg

■ **Cohort expansion: NHL (900 mg and 1200 mg); CLL (600 mg and 900 mg)**

Induction NHL: UTX weekly x 4 in Cycle 1 (Cycle 28 days); **Induction CLL:** UTX Days 1, 8, 15 of Cycles 1 and 2

Maintenance: monthly infusions for patients with \geq SD starting Cycle 3; and infusions every 3 months starting Cycle 6

Ublituximab in RR B-Cell Malignancies: Demographics

Parameter		Type of Lymphoma		
		Evaluable for safety, n	35	Indolent NHL, n
Evaluable for efficacy, n*	30		MZL 8	
Male:Female, n	17:18	CLL/SLL	CLL 8	
Median age, years (range)	66 (45-88)	Aggressive NHL	MCL 5	
			DLBCL 2	

Parameter	iNHL	aNHL	CLL	TOTAL
ECOG 0/1/2 (n)	9 / 11 / 0	2 / 4 / 1	2 / 5 / 1	13 / 20 / 2
Median Prior Therapies: n (range)	3 (1-6)	2 (1-9)	3 (1-6)	3 (1-9)
> 4 Prior Therapies: n (%)	7 (35)	2 (29)	3 (38)	12 (34)
> 2 Prior Rituximab Regimens: n (%)	15 (75)	5 (71)	5 (63)	25 (71)
Refractory to Prior Treatment: n (%)	11 (55)	2 (29)	2 (25)	15 (43)
Refractory to Prior Rituximab: n (%)	12 (60)	2 (29)	1 (13)	15 (43)

*5 pts not evaluable: 4 patients off study prior to first efficacy assessment (2 for non-related AE, 1 for SAE, 1 withdrew consent), 1 too early to evaluate

O'Connor O, et al. Presented at the 19th European Hematology Association; Milan, Italy; June 2014. Abstract 444.

Safety: Single-agent Ublituximab

At Least Possibly Related AE's (in > 5% patients)

All Patients (n=35)		
AE	All Grades, n (%)	Grade 3/4 n (%)
Infusion reaction*	10 (29%)	0
Fatigue	5 (14%)	1 (3%)
Diarrhea	4 (11%)	0
Pain (general)	4 (11%)	0
Dysgeusia	3 (9%)	0
Bilirubin Increase	2 (6%)	0
Pruritus	2 (6%)	0

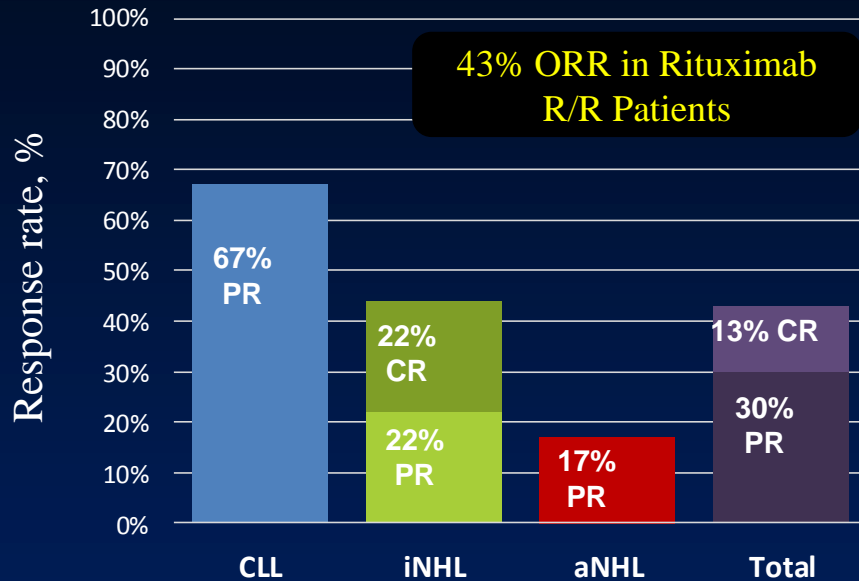
*IRR also includes chills, itching, dyspnea, throat irritation

Laboratory Abnormality (at least possibly related)

AE	CLL (n=8)		NHL (n=27)	
	Grade 1/2, n	Grade 3/4, n	Grade 1/2, n	Grade 3/4, n
Neutropenia	1	3	0	0
Thrombocytopenia	1	1	0	0
Anemia	0	0	0	1

Efficacy of Single Agent Ublituximab

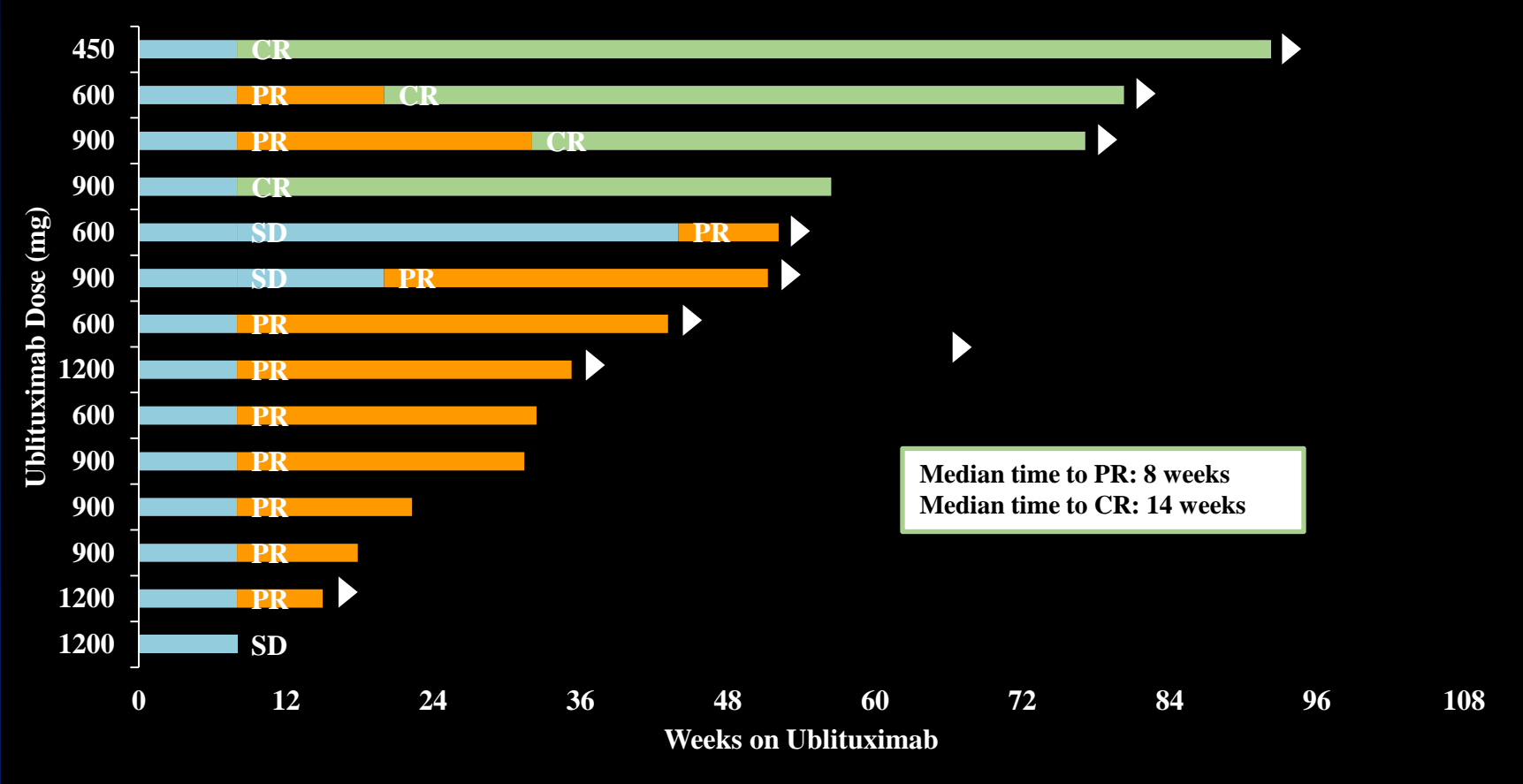
Overall Response by Lymphoma Subtype



Type	n	CR n (%)	PR n (%)	ORR n (%)
CLL	6	-	4 (67)	4 (67)
FL	12	2 (17)	2 (17)	4 (33)
MZL	6	2 (33)	2 (33)	4 (67)
MCL	5	-	-	-
DLBCL	1	-	1 (100)	1 (100)
Total	30	4 (13)	9 (30)	13 (43)

- 43% ORR in rituximab relapsed and refractory patients
- Durable responses: patients in response 2+ years on single agent UTX
- UTX maintenance infusions have improved responses over time

Evolving Responses During Maintenance Ublituximab

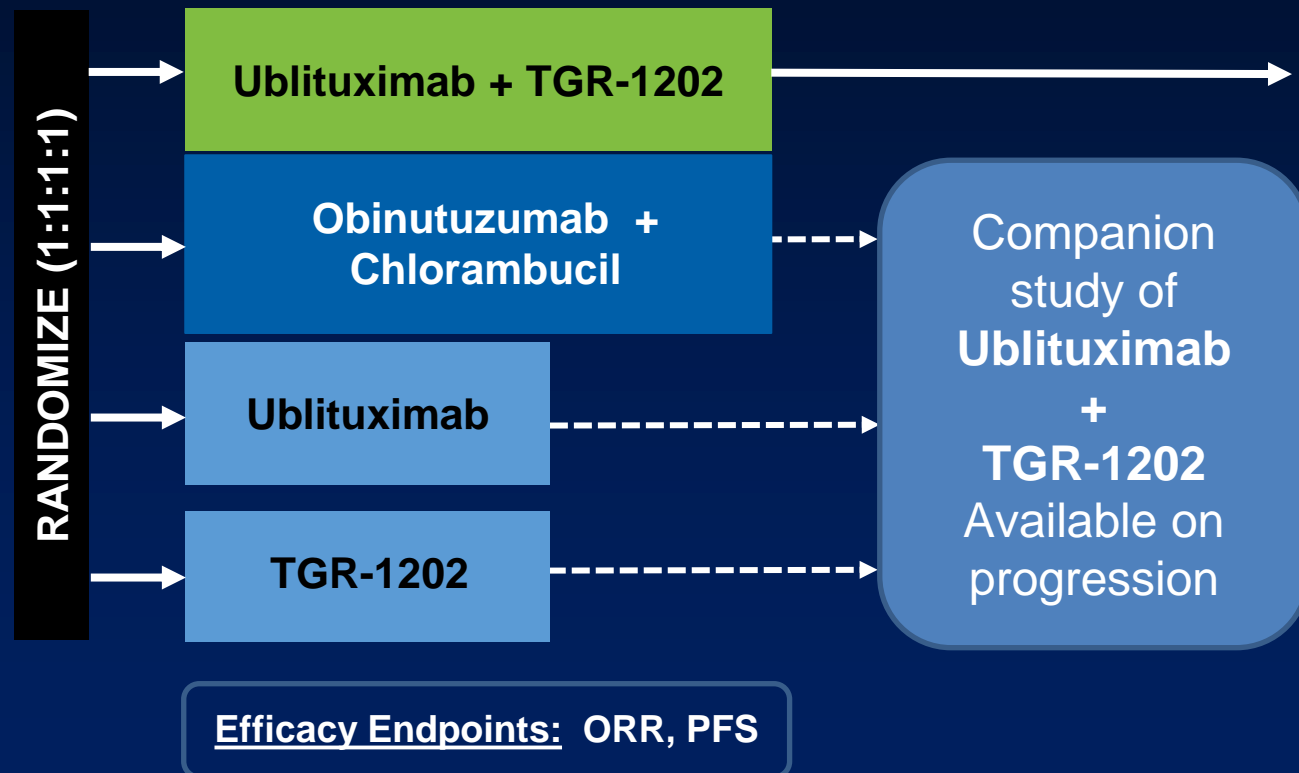


UNITY-CLL 304: Phase 3 Trial for Patients with CLL

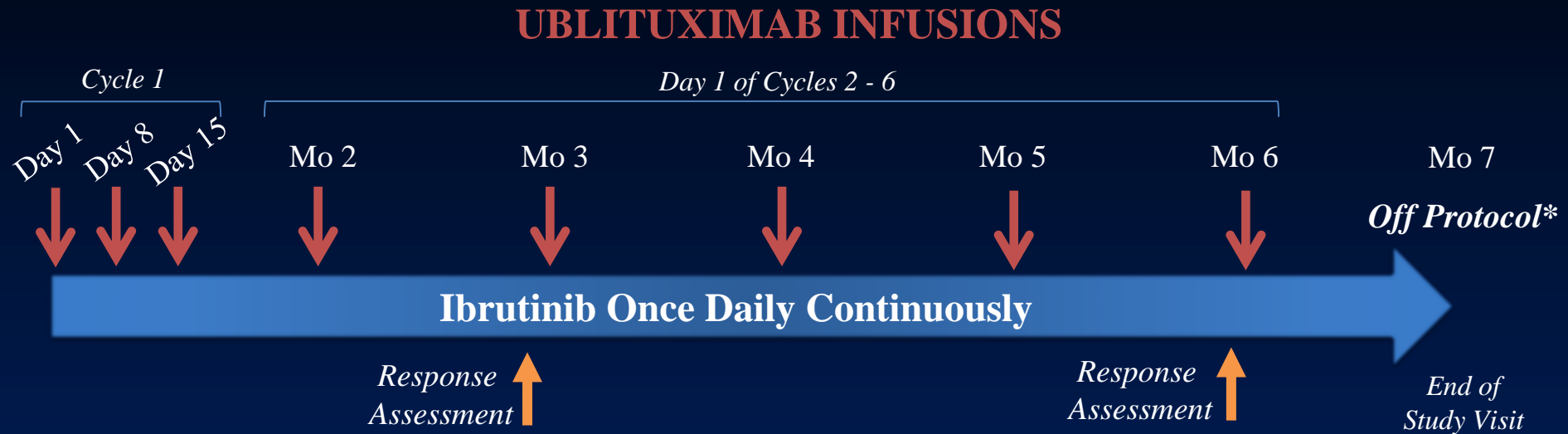
Treatment-naïve or Previously Treated

Key Eligibility Criteria:

- No limit on the number of prior lines of therapy
- ECOG Status 0, 1, or 2
- No prior exposure to a PI3K inhibitor
- No prior exposure to obinutuzumab and/or chlorambucil



Phase II: Ublituximab + Ibrutinib in MCL Study Design



Ublituximab IV: 900 mg on Days 1, 8 and 15 in Cycle 1 followed by Day 1 of Cycles 2 – 6

Ibrutinib: 560 mg on Day 1 and continued daily through Cycle 6

- 2-part study: Part 1 - safety run-in (n=6); Part 2: expansion phase
- Primary endpoints: Safety and ORR
- Secondary: Time to Response and CR rate

Ublituximab + Ibrutinib: Demographics

Evaluable for safety, n	15
Evaluable for efficacy, n	15
Median age, years (range)	71 (55 – 80)
Male/Female, n	13 / 2
ECOG PS 0 / 1, n	9 / 6
Stage 4 disease, n (%)	10 (67)
Prior Regimens, median (range)	3 (1 – 8)
≥ 3 Prior regimens, n (%)	9 (60)
≥ 2 Prior Anti-CD20, n (%)	8 (53)
Prior R-CHOP and/or R-Benda, n (%)	15 (100)
Prior bortezomib, n (%)	6 (40)

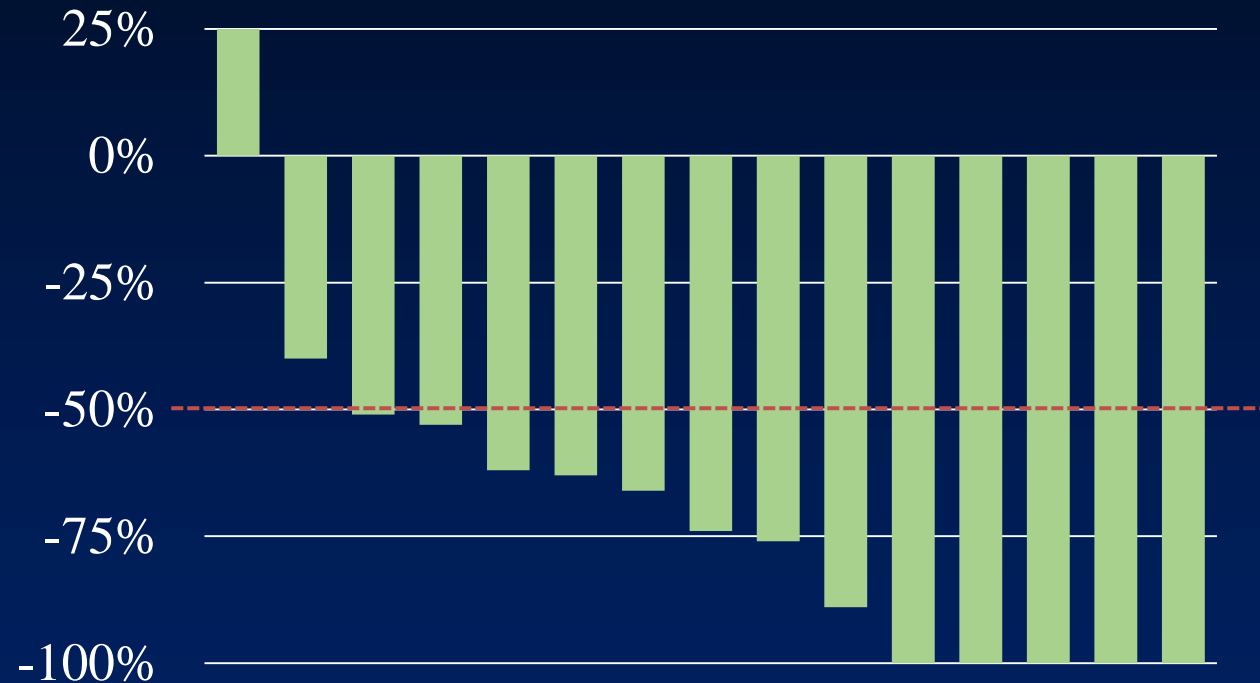
Ublituximab + Ibrutinib: Safety

All Causality AE's in > 2 Patients (n=15)		
Adverse Event	All Grades, n (%)	Grade 3/4, n (%)
Fatigue	8 (53)	1 (7)
Diarrhea	6 (40)	-
Rash	6 (40)	1 (7)
Muscle spasms	5 (33)	-
Nausea	5 (33)	-
Stomatitis	5 (33)	-
Constipation	4 (27)	-
Hypomagnesemia	4 (27)	-
Neutropenia	4 (27)	3 (20)
Thrombocytopenia	4 (27)	-
Contusion	3 (20)	-
Cough	3 (20)	-
Decreased appetite	3 (20)	-
Night sweats	3 (20)	-

- Ibrutinib dose reductions: n=3; 20% (hypertension, rash, fatigue)
 - 1 patient discontinued due to ibrutinib related AE (atrial fibrillation) – atrial fibrillation occurred in 2 patients overall
- No ublituximab dose reductions
- No infusion reactions observed with ublituximab

Ublituximab + Ibrutinib in MCL: Efficacy

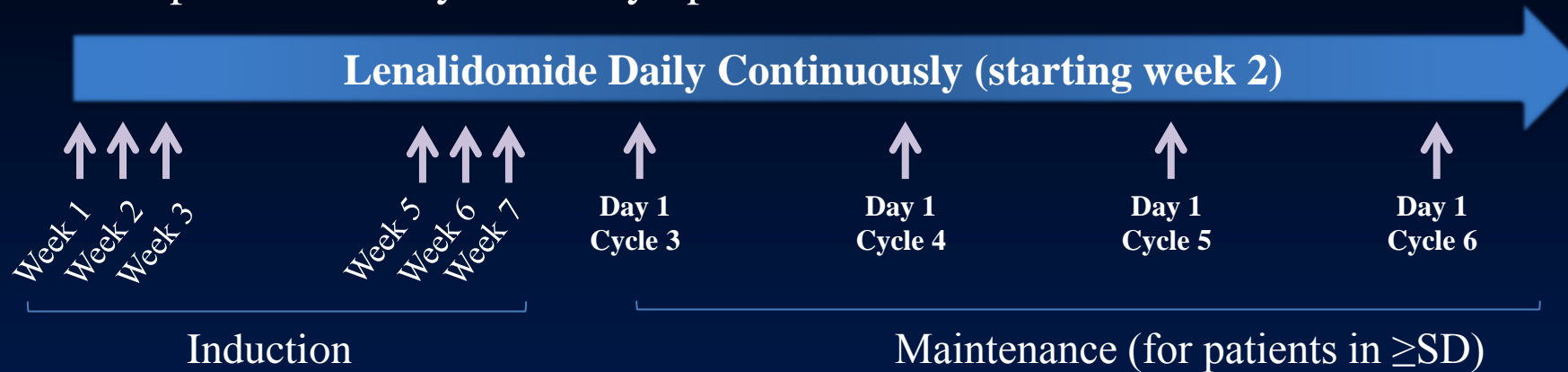
Best % Change in Disease Burden from Baseline



ORR: 87%
CR: 33%

Ublituximab + Lenalidomide: Study Design

- Relapsed/refractory B-cell Lymphoma



UBLITUXIMAB INFUSIONS

Dose Escalation Schema

Cohort	Patients	Ublituximab	Lenalidomide
1	3 – 6	450 mg	10 mg
2	3 – 6	450 mg	15 mg
3	3 – 6	600 mg	10 mg*
4	3 – 6	900 mg	10 mg*

*Lenalidomide dose titrated per patient tolerability. The protocol was amended during Cohort 2 to allow a revised administration schedule for lenalidomide in which patients would start at 10 mg QD, and titrate dose in 5 mg increments per cycle based on individual tolerability.

Ublituximab + Lenalidomide: Baseline Characteristics and Safety

Characteristic	
Evaluable for safety, n	10
Evaluable for efficacy*, n	9
Baseline characteristic	
Median age, years (range)	66 (47-76)
Male/female, n	7/3
ECOG PS, O/1	2/8
Median prior regimens, n (range)	3 (3-6)
≥3 prior rituximab, %	100
Refractory to prior treatment, %	90
Refractory to rituximab, %	70
Prior rituximab-bendamustine, %	90
Prior BTK/PI3K, %	30
Lymphoma subtype, n	
CLL/SLL	5
Follicular lymphoma	1
Mantle cell lymphoma	3
Burkitt lymphoma	1

*1 patient not evaluable due to non-related SAE.

Adverse Event	Total AEs All Grades	UTX related		LEN related	
		Gr 1/2	Gr 3/4	Gr 1/2	Gr 3/4
Infusion reaction	6	5	1	0	0
Neutropenia	5	0	2*	1	4*
Diarrhea	4	0	0	4	0
Constipation	3	0	0	3	0
Fatigue	3	2*	0	3*	0
Nausea	4	1	0	3	0
Anemia	2	0	1*	1	1*
Hoarseness	2	1	0	1	0
Rash	2	0	0	2	0
Tumor flare	2	0	0	2	0

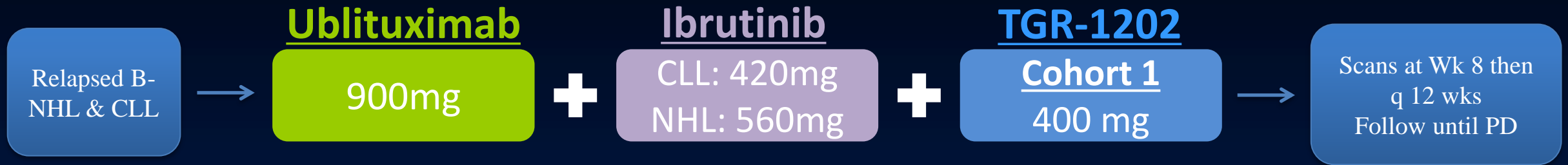
*Causality of some events were attributed to both UTX and LEN

- 3 patients had their LEN dose reduced or withdrawn (2 neutropenia, 1 nausea); 1 had their UTX dose reduced due to neutropenia
- Although no DLT's were reported, dose interruptions or reductions occurred in 6/10 patients while on study

Ublituximab + Lenalidomide: Efficacy

- 22% (2 of 9) patients achieved a PR
 - 1 PR in MCL refractory to idelalisib + rituximab
 - 1 PR in FL refractory to rituximab
 - 22% CLL patients achieved SD > 6 months
- Lymphocyte depletion observed.
 - > 90% reduction in CLL and 80% reduction in MCL after 1 cycle (3 infusions of UTX)

Trial Design: TGR-1202 + Ublituximab + Ibrutinib



- 3 + 3 dose escalation design (CLL and NHL)
- No limit on prior # of therapies
- ECOG Performance Status ≤ 2
- ANC > 500 / Plts > 30,000
- Patients with Richter's Transformation, or refractory to prior PI3K δ inhibitors or prior BTK inhibitors are eligible
- All 3 agents started on Day 1

Endpoints:

- Primary: Safety
- Secondary: ORR, DOR, PFS

Safety: TGR-1202 + Ublituximab + Ibrutinib

Cohort Summary

- CLL and NHL cohorts evaluated separately

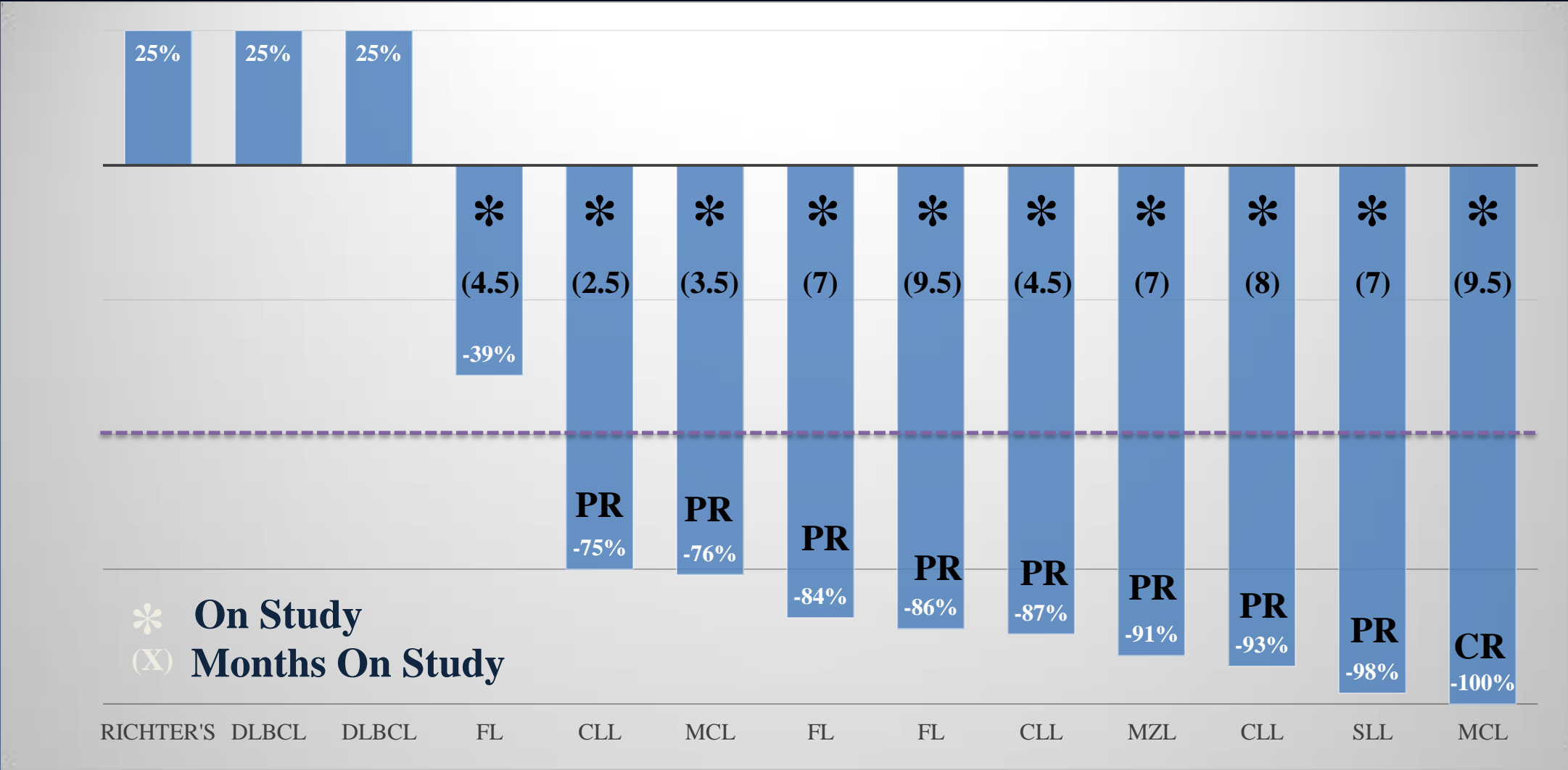
				NHL Pts	# DLT	CLL Pts	# DLT		
1:	Ublituximab 900mg	Ibrutinib 420/560mg	+	TGR-1202 400 mg	→	3	0	5	1*
2:	Ublituximab 900mg	Ibrutinib 420/560mg	+	TGR-1202 600 mg	→	4	0	0	0
3:	Ublituximab 900mg	Ibrutinib 420/560mg	+	TGR-1202 800 mg	→	4	0	0	0

**DLT of reactivated varicella zoster – no additional DLT's to date in CLL cohort*

- Median time on study = 4 mos (range 1 – 9 mos)
- DLT in CLL 400 mg cohort
- 800 mg TGR-1202 cohort cleared in NHL

Activity in NHL: TGR-1202 + Ublituximab + Ibrutinib

BEST PERCENT CHANGE FROM BASELINE IN DISEASE BURDEN



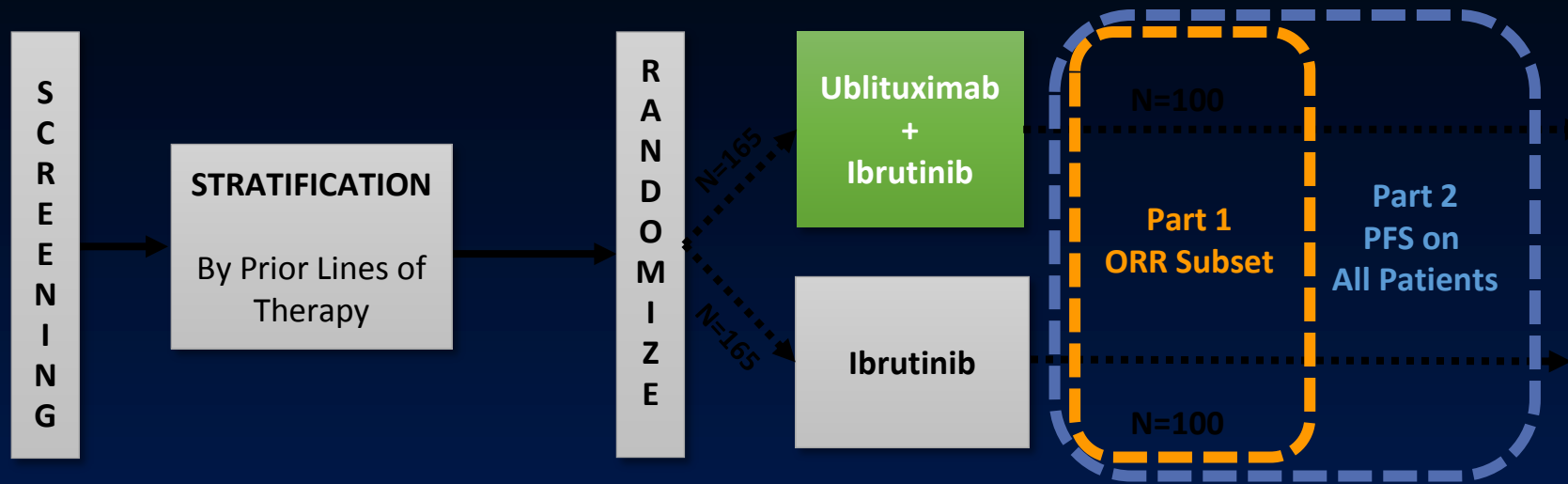
* On Study
 (X) Months On Study

Conclusions

- Ublituximab is a novel type I monoclonal antibody with activity in relapsed CLL and NHL, including patients with rituximab refractory disease.
- Combination studies appear safe with PI3K, Ibrutinib, and lenalidomide.
- Combination studies are underway in multiple B-cell malignancies.

Questions?

The GENUINE Phase 3 Trial



- Design, endpoints, and statistics agreed to via Special Protocol Assessment (SPA)
- Enrolling ~330 patients with high-risk CLL
- Study Chair: Jeff Sharman, MD
- Part 1: ORR among first 200 patients
- Part 2: PFS of all 330 patients
 - Part 1 to be analyzed following full enrolment of study

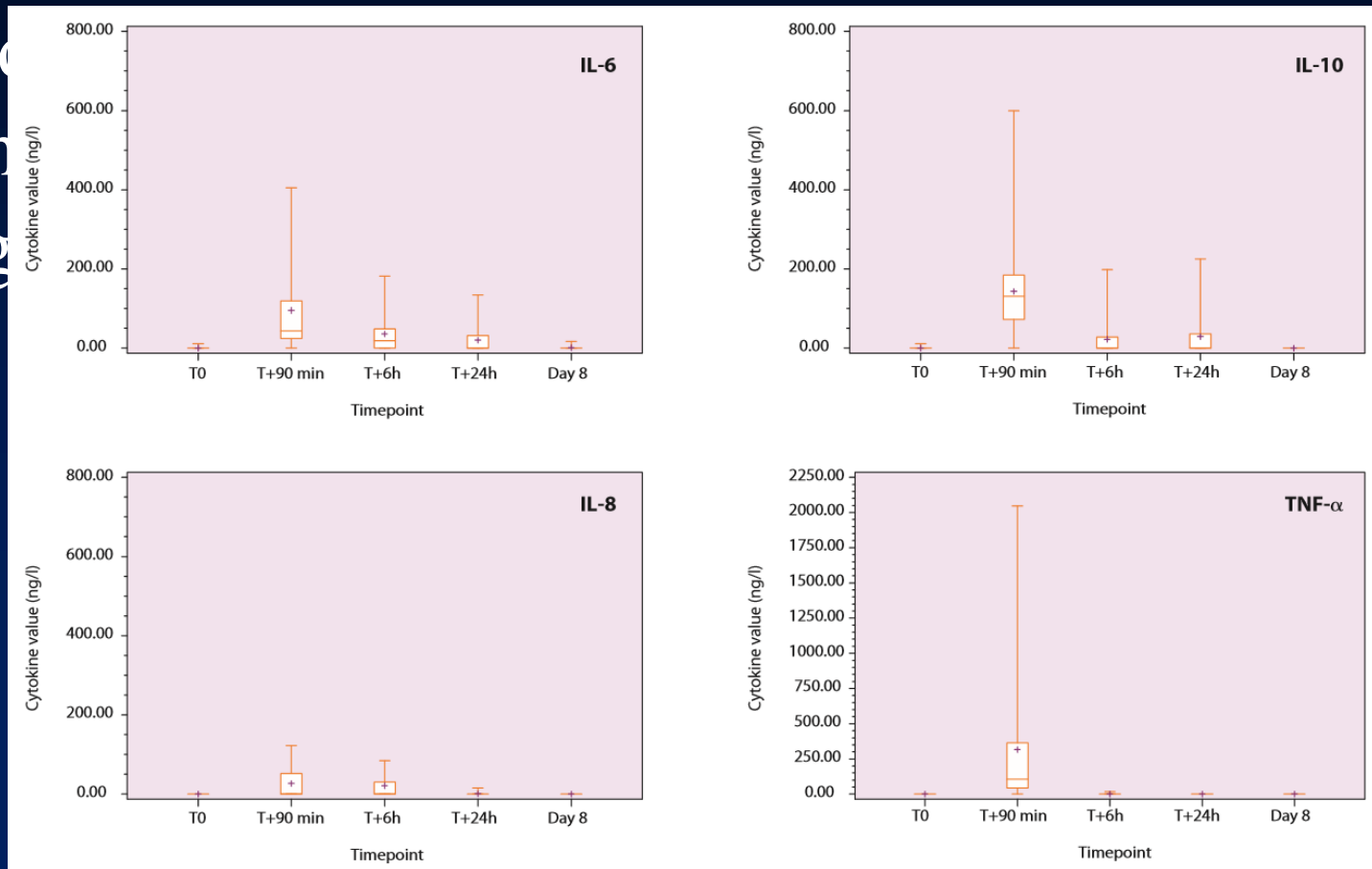


Ublituximab Monotherapy in CLL: Impact on Cytokines

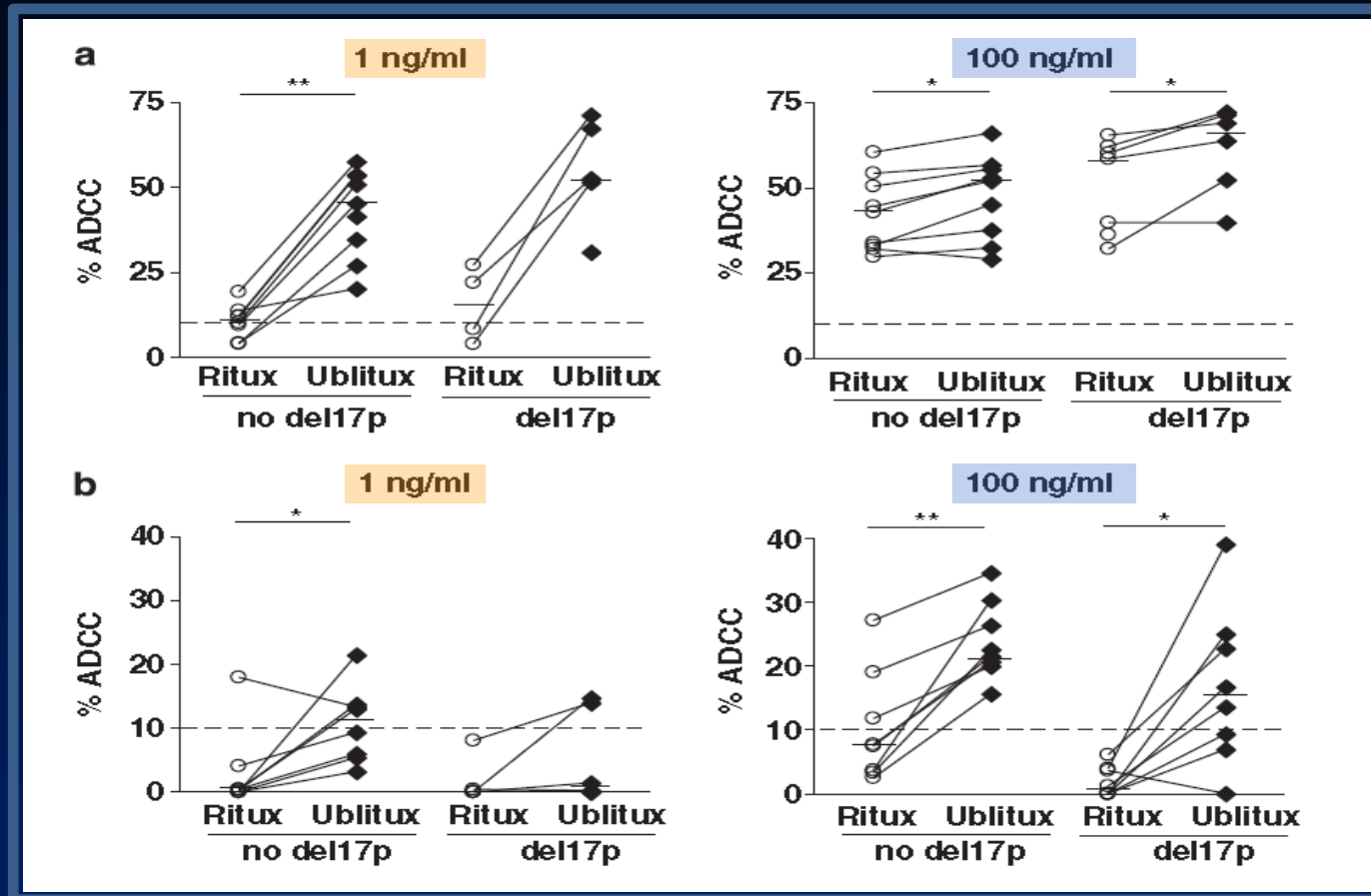
- Plasma IL-6, IL-8, IL-10, and TNF levels significantly increased at 6 hours, at ± 90 minutes,

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Enhanced ADCC with Ublituximab, Independent of p53 Status



(a) ADCC of Raji cells by NK cells from CLL patients ± del17p induced by 1 and 100 ng/mL RTX or UTX

(b) ADCC of CLL B cells by autologous NK cells from CLL patients ± del17p induced by 1 and 100 ng/mL RTX or UTX