FULL PRESCRIBING INFORMATION

1 NAME OF THE MEDICINAL PRODUCT

IMBRUVICA CAPSULES 140mg
IMBRUVICA 140mg TABLETS
IMBRUVICA 280mg TABLETS
IMBRUVICA 420mg TABLETS
IMBRUVICA 560mg TABLETS

2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Each capsule contains 140 mg of ibrutinib

Tablets:

IMBRUVICA 140mg TABLETS	IMBRUVICA 280mg TABLETS	IMBRUVICA 420mg TABLETS	IMBRUVICA 560mg TABLETS
Ibrutinib 140mg	Ibrutinib 280 mg	Ibrutinib 420mg	Ibrutinib 560mg

3 PHARMACEUTICAL FORM

Capsules; size 0, white opaque hard gelatin capsule with black printing "ibr 140 mg", containing off-white to white powder.

Tablets:

140 mg tablets: Yellow green to green round tablets debossed with “ibr” on one side and

“140” on the other side.

280 mg tablets: Purple oblong tablets debossed with “ibr” on one side and “280” on the

other side.

420 mg tablets: Yellow green to green oblong tablets debossed with “ibr” on one side and

“420” on the other side.

560 mg tablets: Yellow to orange oblong tablets debossed with “ibr” on one side and

“560” on the other side.

4 INDICATIONS AND USAGE

4.1 Mantle Cell Lymphoma

– IMBRUVICA in combination with rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisolone (IMBRUVICA + R-CHOP) alternating with R-DHAP (or R-DHAOx) without IMBRUVICA, followed by IMBRUVICA monotherapy, is indicated for the treatment of adult patients with previously

untreated mantle cell lymphoma (MCL) who would be eligible for autologous stem cell transplantation (ASCT).

– IMBRUVICA is indicated for the treatment of adult patients with mantle cell lymphoma (MCL) who have received at least one prior therapy.

4.2 Chronic Lymphocitic Leukemia/ Small Lymphocytic Lymphoma Lymphoma

IMBRUVICA is indicated for the treatment of adult patients with chronic lymphocytic leukemia (CLL)/small lymphocytic lymphoma (SLL).

4.3 Chronic Lymphocytic Leukemia/Small Lymphocytic Lymphoma with 17p deletion

IMBRUVICA is indicated for the treatment of adult patients with chronic lymphocytic leukemia (CLL)/small lymphocytic lymphoma (SLL) with 17p deletion.

4.4 Waldenström's Macroglobulinemia

IMBRUVICA is indicated for the treatment of adult patients with Waldenström's macroglobulinemia (WM).

4.5 Marginal Zone Lymphoma

IMBRUVICA is indicated for the treatment of adult patients with marginal zone lymphoma (MZL) who require systemic therapy and have received at least one prior anti-CD20-based therapy.

4.6 Chronic Graft versus Host Disease

IMBRUVICA is indicated for the treatment of adult patients with chronic graft-versus-host disease (cGVHD) after failure of one or more lines of systemic therapy.

5. DOSAGE AND ADMINISTRATION

5.1 Recommended Dosage

Treatment of adult patients with previously untreated MCL

The recommended dose for the treatment of previously untreated MCL is ibrutinib 560 mg once daily (see Table 1).

Table 1: IMBRUVICA dosing schedule for previously untreated MCL

Treatment	Cycle number	Treatment	IMBRUVICA
Part I[*]	1, 3, 5	IMBRUVICA in combination with R-CHOP[§]	On days 1-19
	2, 4, 6	R-DHAP[#§]	Without IMBRUVICA
Part II[±]		IMBRUVICA	Daily for 24 Months

R-CHOP= rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisolone; R-DHAP= rituximab, dexamethasone, cytarabine, cisplatin
[*]6 cycles; each cycle is 21 days
[§]See the Summary of Product Characteristics (SmPC) for dosing information for each medicinal product.
[#]Interchangeable with R-DHAOx (rituximab, dexamethasone, cytarabine, oxaliplatin)[§].
[±] Treatment should start after recovery of peripheral blood counts. Rituximab may be added as per national treatment guidelines.

Treatment of adult patients with MCL who have received at least one prior therapy and patients with Marginal Zone Lymphoma

The recommended dosage of IMBRUVICA for MCL and MZL is 560 mg orally once daily until disease progression or unacceptable toxicity.

Chronic Lymphocytic Leukemia/Small Lymphocytic Lymphoma and Waldenström's Macroglobulinemia

The recommended dosage of IMBRUVICA for CLL/SLL and WM is 420 mg orally once daily until disease progression or unacceptable toxicity.

For CLL/SLL, IMBRUVICA can be administered as a single agent, in combination with rituximab or Obinutuzumab (BR), or in combination with bendamustine and rituximab (BR), or in combination with venetoclax. In the co-morbid and elderly population the combination should be used with more caution In combination with venetoclax for the treatment of CLL, IMBRUVICA should be administered as a single agent for 3 cycles (1 cycle is 28 days), followed by 12 cycles of IMBRUVICA plus venetoclax. See the venetoclax Summary of Product Characteristics (SmPC) for full venetoclax dosing information.

For WM, IMBRUVICA can be administered as a single agent or in combination with rituximab.

When administering IMBRUVICA in combination with rituximab or obinutuzumab, consider administering IMBRUVICA prior to rituximab or obinutuzumab when given on the same day.

Chronic Graft versus Host Disease

The recommended dosage of IMBRUVICA for cGVHD is 420 mg orally once daily until cGVHD progression, recurrence of an underlying malignancy, or unacceptable toxicity. When a patient no longer requires therapy for the treatment of cGVHD, IMBRUVICA should be discontinued considering the medical assessment of the individual patient.

Administration

Administer IMBRUVICA at approximately the same time each day with a glass of water.

Swallow tablets or capsule whole. Do not open, break, or chew the capsules. Do not cut, crush, or chew the tablets.

If a dose of IMBRUVICA is not taken at the scheduled time, it can be taken as soon as possible on the same day with a return to the normal schedule the following day. Do not take extra doses of IMBRUVICA to make up for the missed dose.

5.2 DOSAGE MODIFICATIONS FOR ADVERSE REACTIONS

For adverse reactions listed in Table 2, interrupt IMBRUVICA therapy. Once the adverse reaction has improved to Grade 1 or baseline (recovery), follow the recommended dosage modifications (see Table 1).

Table 2: Recommended Dosage Modifications for Adverse Reactions

Adverse Reaction[a,b]	Occurrence	Dose Modification for MCL and MZL After Recovery Starting Dose = 560 mg	Dose Modification for CLL/SLL, WM, and cGVHD After Recovery Starting Dose = 420 mg
Grade 2 cardiac failure	First	Restart at 420 mg daily[c]	Restart at 280 mg daily[c]
	Second	Restart at 280 mg daily[c]	Restart at 140 mg daily[c]
	Third	Discontinue IMBRUVICA	Discontinue IMBRUVICA
Grade 3 cardiac arrhythmias	First	Restart at 420 mg daily[c]	Restart at 280 mg daily[c]
	Second	Discontinue IMBRUVICA	Discontinue IMBRUVICA
Grade 3 or 4 cardiac failure Grade 4 cardiac arrhythmias	First	Discontinue IMBRUVICA	Discontinue IMBRUVICA
Other Grade 3 or 4 non-hematological toxicities[d] Grade 3 or 4 neutropenia with infection or fever Grade 4 hematological toxicities	First	Restart at 420 mg daily	Restart at 280 mg daily
	Second	Restart at 280 mg daily	Restart at 140 mg daily
	Third	Discontinue IMBRUVICA	Discontinue IMBRUVICA

[a] See *Warnings and Precautions (5)*.

[b] Grading based on National Cancer Institute-Common Terminology Criteria for Adverse Events (NCI-CTCAE) criteria, or International Workshop on Chronic Lymphocytic Leukemia (iwCLL) criteria for hematologic toxicities in CLL/SLL.

[c] Evaluate the benefit-risk before resuming treatment.

[d] For Grade 4 non-hematologic toxicities, evaluate the benefit-risk before resuming treatment.

5.3 Dosage Modifications for Use with CYP3A Inhibitors

Recommended dosage modifications are described below *[see Drug Interactions (10.1)]*:

Table 3: Recommended Dosage Modifications for Use with CYP3A Inhibitors

Patient Population	Coadministered Drug	Recommended IMBRUVICA Dosage
B-Cell Malignancies	• Moderate CYP3A inhibitor	280 mg once daily Modify dose as recommended *[see Dosage and Administration (.2)]*.

Patient Population	Coadministered Drug	Recommended IMBRUVICA Dosage
	• Voriconazole 200 mg twice daily • Posaconazole suspension 100 mg once daily, 100 mg twice daily, or 200 mg twice daily	140 mg once daily Modify dose as recommended *[see Dosage and Administration (.2)]*.
	• Other strong CYP3A inhibitors	Avoid concomitant use. If these inhibitors will be used short-term (such as anti-infectives for seven days or less), interrupt IMBRUVICA.
Chronic Graft versus Host Disease	• Moderate CYP3A inhibitor	420 mg once daily Modify dose as recommended *[see Dosage and Administration (.2)]*.
	• Voriconazole 200 mg twice daily • Posaconazole suspension 100 mg once daily, 100 mg twice daily, or 200 mg twice daily	280 mg once daily Modify dose as recommended *[see Dosage and Administration (.2)]*.
	• Posaconazole suspension 200 mg three times daily or 400 mg twice daily • Posaconazole intravenously 300 mg once daily • Posaconazole delayed-release tablets 300 mg once daily	140 mg once daily Interrupt dose as recommended *[see Dosage and Administration (.2)]*.
	• Other strong CYP3A inhibitors	Avoid concomitant use. If these inhibitors will be used short-term (such as anti-infectives for seven days or less), interrupt IMBRUVICA.

After discontinuation of a CYP3A inhibitor, resume previous dose of IMBRUVICA *[see Dosage and Administration (5.1), Drug Interactions (10.1)]*.

5.4 Dosage Modifications for Use in Hepatic Impairment

The recommended dosage is 140 mg daily for patients with mild hepatic impairment (Child-Pugh class A).

Avoid the use of IMBRUVICA in patients with severe hepatic impairment (Child-Pugh class C) *[see Use in Specific Populations (11.6), Clinical Pharmacology (14.3)]*.

6. DOSAGE FORMS AND STRENGTHS

[See Pharmaceutical form (3)].

7. CONTRAINDICATIONS

Hypersensitivity to the active substance or to any of the excipients (listed in section 17.1).

8. WARNINGS AND PRECAUTIONS

8.1 Hemorrhage

Fatal bleeding events have occurred in patients who received IMBRUVICA. Major hemorrhage (≥ Grade 3, serious, or any central nervous system events; e.g., intracranial hemorrhage [including subdural hematoma], gastrointestinal bleeding, hematuria, and post procedural hemorrhage) occurred in 4.2% of patients, with fatalities occurring in 0.4% of 2,838 patients who received IMBRUVICA in 27 clinical trials. Bleeding events of any grade including bruising and petechiae occurred in 39%, and excluding bruising and petechiae occurred in 23% of patients who received IMBRUVICA, respectively *[see Adverse Reactions (9.1)]*.

The mechanism for the bleeding events is not well understood.

Use of either anticoagulant or antiplatelet agents concomitantly with IMBRUVICA increases the risk of major hemorrhage. Across clinical trials, 3.1% of 2,838 patients who received IMBRUVICA without antiplatelet or anticoagulant therapy experienced major hemorrhage. The addition of antiplatelet therapy with or without anticoagulant therapy increased this percentage to 4.4%, and the addition of anticoagulant therapy with or without antiplatelet therapy increased this percentage to 6.1%. Consider the risks and benefits of anticoagulant or antiplatelet therapy when co-administered with IMBRUVICA. Monitor for signs and symptoms of bleeding.

Consider the benefit-risk of withholding IMBRUVICA for at least 3 to 7 days pre- and post-surgery depending upon the type of surgery and the risk of bleeding *[see Clinical Studies ()]*.

8.2 Infections

Fatal and non-fatal infections (including bacterial, viral, or fungal) have occurred with IMBRUVICA therapy. Grade 3 or greater infections occurred in 21% of 1,476 patients who received IMBRUVICA in clinical trials *[see Adverse Reactions (9.1, 9.2)]*. Cases of progressive multifocal leukoencephalopathy (PML) and Pneumocystis jirovecii pneumonia (PJP) have occurred in patients treated with IMBRUVICA. Consider prophylaxis according to standard of care in patients who are at increased risk for opportunistic infections. Monitor and evaluate patients for fever and infections and treat appropriately.

8.3 Cardiac Arrhythmias, Cardiac Failure, and Sudden Death

Fatal and serious cardiac arrhythmias and cardiac failure have occurred with IMBRUVICA. Deaths due to cardiac causes or sudden deaths occurred in 1% of 4,896 patients who received IMBRUVICA in clinical trials, including in patients who received IMBRUVICA in unapproved monotherapy or combination regimens. These adverse reactions occurred in patients with and without preexisting hypertension or cardiac comorbidities. Patients with cardiac comorbidities may be at greater risk of these events.

Grade 3 or greater ventricular tachyarrhythmias were reported in 0.2%, Grade 3 or greater atrial fibrillation and atrial flutter were reported in 3.7%, and Grade 3 or greater cardiac failure was reported in 1.3% of 4,896 patients who received IMBRUVICA in clinical trials, including in patients who received IMBRUVICA in unapproved monotherapy or combination regimens. These events have occurred particularly in patients with cardiac risk factors including hypertension and diabetes mellitus, a previous history of cardiac arrhythmias, and in patients with acute infections *[see Adverse Reactions (9.1)]*.

Evaluate cardiac history and function at baseline, and monitor patients for cardiac arrhythmias and cardiac function. Obtain further evaluation (e.g., ECG, echocardiogram) as indicated for patients who develop

symptoms of arrhythmia (e.g., palpitations, lightheadedness, syncope, chest pain), new onset dyspnea, or other cardiovascular concerns. Manage cardiac arrhythmias and cardiac failure appropriately, follow dose modification guidelines *[see Dosage and Administration (5.2)]*, *)]*, and consider the risks and benefits of continued IMBRUVICA treatment.

8.4 Hypertension

Hypertension occurred in 19% of 1,476 patients who received IMBRUVICA in clinical trials. Grade 3 or greater hypertension occurred in 8% of patients *[see Adverse Reactions (9.1)]*. Based on data from 1,124 of these patients, the median time to onset was 5.9 months (range, 0.03 to 24 months).

Monitor blood pressure in patients treated with IMBRUVICA, initiate or adjust anti-hypertensive medication throughout treatment with IMBRUVICA as appropriate, and follow dosage modification guidelines for Grade 3 or higher hypertension *[see Dosage and Administration (5.2)]*.

8.5 Cytopenias

In 645 patients with B-cell malignancies who received IMBRUVICA as a single agent, grade 3 or 4 neutropenia occurred in 23% of patients, grade 3 or 4 thrombocytopenia in 8% and grade 3 or 4 anemia in 2.8%, based on laboratory measurements *[see Adverse Reactions (9.1)]*.

Monitor complete blood counts monthly.

8.6 Second Primary Malignancies

Other malignancies (10%), including non-skin carcinomas (3.9%), occurred among the 1,476 patients who received IMBRUVICA in clinical trials *[see Adverse Reactions (9.1)]*. The most frequent second primary malignancy was non-melanoma skin cancer (6%).

8.7 Hepatotoxicity, Including Drug-Induced Liver Injury

Hepatotoxicity, including severe, life-threatening, and potentially fatal cases of drug-induced liver injury (DILI), has occurred in patients treated with Bruton tyrosine kinase inhibitors, including IMBRUVICA.

Evaluate bilirubin and transaminases at baseline and throughout treatment with IMBRUVICA. For patients who develop abnormal liver tests after IMBRUVICA, monitor more frequently for liver test abnormalities and clinical signs and symptoms of hepatic toxicity. If DILI is suspected, withhold IMBRUVICA. Upon confirmation of DILI, discontinue IMBRUVICA.

8.8 Tumor Lysis Syndrome

Tumor lysis syndrome (TLS) has been infrequently reported with IMBRUVICA *[see Adverse Reactions (9.2)]*. Assess the baseline risk (e.g., high tumor burden) and take appropriate precautions. Monitor patients closely and treat as appropriate.

8.9 Embryo-Fetal Toxicity

Based on findings in animals, IMBRUVICA can cause fetal harm when administered to a pregnant woman. Administration of ibrutinib to pregnant rats and rabbits during the period of organogenesis caused embryo-fetal toxicity including malformations at exposures that were 2-20 times higher than those reported in patients with hematologic malignancies. Advise pregnant women of the potential risk to a fetus. Advise females of reproductive potential to use effective contraception during treatment with IMBRUVICA and for 3 months after the last dose. *[see Use in Specific Populations (11.1)]*.

9 ADVERSE REACTIONS

The following clinically significant adverse reactions are described elsewhere in the labeling:

- Hemorrhage *[see Warnings and Precautions (8.1)]*
- Infections *[see Warnings and Precautions (8.2)]*
- Cardiac Arrhythmias, Cardiac Failure,and Sudden Death *[see Warnings and Precautions (8.3)]*
- Hypertension *[see Warnings and Precautions (8.4)]*
- Cytopenias *[see Warnings and Precautions (8.5)]*
- Second Primary Malignancies *[see Warnings and Precautions (8.6)]*
- Hepatotoxicity, including DILI [see Warnings and Precautions (8.7)]
- Tumor Lysis Syndrome *[see Warnings and Precautions (8.8)]*

9.1 Clinical Trials Experience

Because clinical trials are conducted under widely variable conditions, adverse event rates observed in clinical trials of a drug cannot be directly compared with rates of clinical trials of another drug and may not reflect the rates observed in practice.

The pooled safety population described in the WARNINGS AND PRECAUTIONS reflects exposure to IMBRUVICA in 6 trials administered as a single agent at 420 mg orally once daily (475 patients) or at 560 mg orally once daily (174 patients), and in 4 trials administered in combination with other drugs at 420 mg orally once daily (827 patients) in patients with B-cell malignancies. In this pooled safety population of 1,476 patients, 87% were exposed for 6 months or longer and 68% were exposed for greater than one year; the most common adverse reactions (≥30%) were thrombocytopenia, diarrhea, fatigue, musculoskeletal pain, neutropenia, rash, anemia, and bruising.

Certain subsections in the WARNINGS AND PRECAUTIONS include patients who received IMBRUVICA in unapproved monotherapy or combination regimens.

Mantle Cell Lymphoma

TRIANGLE

Summary for patients with previously untreated MCL who were eligible for ASCT

The safety profile is based on data from 265 patients (in the IMBRUVICA arm) treated with IMBRUVICA in the phase 3 TRIANGLE study. Patients received IMBRUVICA at 560 mg once daily according to the

TRIANGLE treatment schedule (see section 5.1). The median treatment duration was 28.5 months in the IMBRUVICA arm.

Table 4: Adverse reactions reported in the IMBRUVICA arm of the TRIANGLE Study†

		N=265		
System Organ Class	**Frequency (All Grades)**	**Adverse Reactions**	**All Grades (%)**	**Grade ⩾3 (%)**
Infections and infestations	Very common	Pneumonia* #	16	9
		Skin infection*	12	3
	Common	Upper respiratory tract infection	6	<1
		Sepsis*	2	2
		Urinary tract infection	6	<1
		Sinusitis*	6	1
	Uncommon	Aspergillus infections*	1	<1
Neoplasms benign, malignant and unspecified (incl cysts and polyps)	Common	Non-Melanoma skin cancer*	1	<1
		Basal cell carcinoma	1	<1
Blood and lymphatic system disorders	Very common	Thrombocytopenia*	69	61
		Neutropenia*	63	60
		Febrile neutropenia	14	14
	Common	Leukocytosis	3	1
Immune system disorders	Common	Interstitial lung disease*	5	1
Metabolism and nutrition disorders	Common	Hyperuricaemia	8	3
		Tumour lysis syndrome*	3	3
Nervous system disorders	Very common	Peripheral neuropathy*	35	3
		Headache	11	1
	Common	Dizziness	6	<1
	Uncommon	Transient ischaemic attack	1	0
Eye disorders	Uncommon	Vision blurred	1	0
		Eye haemorrhage	<1	0
Cardiac disorders	Common	Atrial fibrillation	10	4
		Cardiac failure*	2	0
Vascular disorders	Very common	Haemorrhage*	14	2
		Hypertension*	14	5
	Common	Bruising*	8	1
		Epistaxis	6	1
		Petechiae	3	0
Gastrointestinal disorders	Very common	Nausea	32	4
		Diarrhoea	28	5
		Vomiting	18	4
		Stomatitis*	11	2
		Constipation	17	<1
	Common	Dyspepsia	8	0
	Very common	Rash*	23	2
	Common	Erythema	5	0

Skin and subcutaneous tissue disorders		Onychoclasis	2	0
	Uncommon	Urticaria	<1	0
		Angioedema	1	0
		Cutaneous vasculitis	<1	0
		Panniculitis*	1	0
Musculoskeletal and connective tissue disorders	Very common	Musculoskeletal pain*	19	2
	Common	Muscle spasms	9	1
		Arthralgia	8	1
Renal and urinary disorders	Very common	Acute kidney injury	11	5
General disorders and administration site conditions	Very common	Pyrexia	22	2
	Common	Oedema peripheral	5	0
Investigations	Very common	Blood creatinine increased	16	1

† Frequencies are rounded to the nearest integer.
* Terms required grouping.
# Includes events with fatal outcome.

Description of selected adverse reactions

Discontinuation and dose reduction due to adverse reactions

In the phase 3 TRIANGLE study involving 265 patients with previously untreated MCL who were eligible for ASCT treatment discontinuation due to adverse reactions was observed in 13% in the IMBRUVICA arm. These included neutropenia, pneumonia, atrial fibrillation, acute kidney injury, diarrhoea, rash, and interstitial lung disease. Adverse reactions leading to dose reduction occurred in approximately 12% in the IMBRUVICA arm.

Study 1104

The data described below reflect exposure to IMBRUVICA in a clinical trial (Study 1104) that included 111 patients with previously treated MCL treated with 560 mg daily with a median treatment duration of 8.3 months.The most common adverse reactions (≥ 20%) were thrombocytopenia, diarrhea, neutropenia, anemia, fatigue, musculoskeletal pain, peripheral edema, upper respiratory tract infection, nausea, bruising, dyspnea, constipation, rash, abdominal pain, vomiting and decreased appetite (see Table 5 and Table 6).

The most common Grade 3 or 4 non-hematological adverse reactions (≥ 5%) were pneumonia, abdominal pain, atrial fibrillation, diarrhea, fatigue, and skin infections.

Fatal and serious cases of renal failure have occurred with IMBRUVICA therapy. Increases in creatinine 1.5 to 3 times the upper limit of normal (ULN) occurred in 9% of patients.

Adverse reactions from the MCL trial (N=111) using single agent IMBRUVICA 560 mg daily occurring at a rate of ≥10% are presented in Table 5.

Table 5: Non-Hematologic Adverse Reactions in ≥ 10% of Patients with MCL (N=111)

Body System	Adverse Reaction	All Grades (%)	Grade 3 or Higher (%)
Gastrointestinal disorders	Diarrhea	51	5
	Nausea	31	0
	Constipation	25	0
	Abdominal pain	24	5
	Vomiting	23	0
	Stomatitis	17	1
	Dyspepsia	11	0
General disorders and administration site conditions	Fatigue	41	5
	Peripheral edema	35	3
	Pyrexia	18	1
	Asthenia	14	3
Musculoskeletal and connective tissue disorders	Musculoskeletal pain	37	1
	Muscle spasms	14	0
	Arthralgia	11	0
Infections and infestations	Upper respiratory tract infection	34	0
	Urinary tract infection	14	3
	Pneumonia	14	8†
	Skin infections	14	5
	Sinusitis	13	1
Skin and subcutaneous tissue disorders	Bruising	30	0
	Rash	25	3
	Petechiae	11	0
Respiratory, thoracic and mediastinal disorders	Dyspnea	27	5†
	Cough	19	0
	Epistaxis	11	0
Metabolism and nutrition disorders	Decreased appetite	21	2
	Dehydration	12	4
Nervous system disorders	Dizziness	14	0
	Headache	13	0

† Includes one event with a fatal outcome.

Table 6: Treatment-Emergent* Hematologic Laboratory Abnormalities in Patients with MCL (N=111)

	Percent of Patients (N=111)	
	All Grades (%)	Grade 3 or 4 (%)
Platelets decreased	57	17
Neutrophils decreased	47	29
Hemoglobin decreased	41	9

* Based on laboratory measurements and adverse reactions

Treatment-emergent Grade 4 thrombocytopenia (6%) and neutropenia (13%) occurred in patients.

Ten patients (9%) discontinued treatment due to adverse reactions in the trial (N=111). The most frequent adverse reaction leading to treatment discontinuation was subdural hematoma (1.8%). Adverse reactions leading to dose reduction occurred in 14% of patients.

Patients with MCL who develop lymphocytosis greater than 400,000/mcL have developed intracranial hemorrhage, lethargy, gait instability, and headache. However, some of these cases were in the setting of disease progression.

Forty percent of patients had elevated uric acid levels on study including 13% with values above 10 mg/dL. Adverse reaction of hyperuricemia was reported for 15% of patients.

Chronic Lymphocytic Leukemia/Small Lymphocytic Lymphoma

The data described below reflect exposure to IMBRUVICA in one single-arm, open-label clinical trial (Study 1102) and five randomized controlled clinical trials (RESONATE, RESONATE-2, HELIOS, iLLUMINATE, and E1912) in patients with CLL/SLL (n=2,016 total, including n=1,133 patients exposed to IMBRUVICA). In general, patients with creatinine clearance (CLcr) ≤ 30 mL/min, AST or ALT ≥ 2.5 x ULN, or total bilirubin ≥ 1.5 x ULN (unless of non-hepatic origin) were excluded from these trials. In Study E1912, patients with AST or ALT > 3 x ULN or total bilirubin > 2.5 x ULN were excluded. Study 1102 included 51 patients with previously treated CLL/SLL. RESONATE included 386 randomized patients with previously treated CLL or SLL who received single agent IMBRUVICA or ofatumumab. RESONATE-2 included 267 randomized patients with treatment naïve CLL or SLL who were 65 years or older and received single agent IMBRUVICA or chlorambucil. HELIOS included 574 randomized patients with previously treated CLL or SLL who received IMBRUVICA in combination with BR or placebo in combination with BR. iLLUMINATE included 228 randomized patients with treatment naïve CLL/SLL who were 65 years or older or with coexisting medical conditions and received IMBRUVICA in combination with obinutuzumab or chlorambucil in combination with obinutuzumab. E1912 included 510 patients with previously untreated CLL/SLL who were 70 years or younger and received IMBRUVICA in combination with rituximab or received fludarabine, cyclophosphamide, and rituximab (FCR).

The most common adverse reactions in patients with CLL/SLL receiving IMBRUVICA (≥ 30%) were thrombocytopenia, diarrhea, fatigue, musculoskeletal pain, neutropenia, rash, anemia, bruising, and nausea.

Four to 10 percent of patients with CLL/SLL receiving IMBRUVICA discontinued treatment due to adverse reactions. These included pneumonia, hemorrhage, atrial fibrillation, neutropenia, arthralgia, rash, and thrombocytopenia. Adverse reactions leading to dose reduction occurred in approximately 9% of patients.

Study 1102

Adverse reactions and laboratory abnormalities from Study 1102 (N=51) using single agent IMBRUVICA 420 mg daily in patients with previously treated CLL/SLL occurring at a rate of ≥ 10% with a median duration of treatment of 15.6 months are presented in Table 7 and Table 8.

Table 7: Non-Hematologic Adverse Reactions in ≥ 10% of Patients with CLL/SLL (N=51) in Study 1102

Body System	Adverse Reaction	All Grades (%)	Grade 3 or Higher (%)
Gastrointestinal disorders	Diarrhea	59	4
	Constipation	22	2
	Nausea	20	2
	Stomatitis	20	0
	Vomiting	18	2
	Abdominal pain	14	0
	Dyspepsia	12	0
Skin and subcutaneous tissue disorders	Bruising	51	2
	Rash	25	0
	Petechiae	16	0
Infections and infestations	Upper respiratory tract infection	47	2
	Sinusitis	22	6
	Skin infection	16	6
	Pneumonia	12	10
	Urinary tract infection	12	2
General disorders and administration site conditions	Fatigue	33	6
	Pyrexia	24	2
	Peripheral edema	22	0
	Asthenia	14	6
	Chills	12	0
Musculoskeletal and connective tissue disorders	Musculoskeletal pain	25	6
	Arthralgia	24	0
	Muscle spasms	18	2
Respiratory, thoracic and mediastinal disorders	Cough	22	0
	Oropharyngeal pain	14	0
	Dyspnea	12	0
Nervous system disorders	Dizziness	20	0
	Headache	18	2
Vascular disorders	Hypertension	16	8
Metabolism and nutrition disorders	Decreased appetite	16	2
Neoplasms benign, malignant, unspecified	Second malignancies	10	2[†]

[†]One patient death due to histiocytic sarcoma.

Table 8: Treatment-Emergent* Hematologic Laboratory Abnormalities in Patients with CLL/SLL (N=51) in Study 1102

	Percent of Patients (N=51)	
	All Grades (%)	Grade 3 or 4 (%)
Platelets decreased	69	12
Neutrophils decreased	53	26
Hemoglobin decreased	43	0

* Based on laboratory measurements per IWCLL criteria and adverse reactions.
Treatment-emergent Grade 4 thrombocytopenia (8%) and neutropenia (12%) occurred in patients.

RESONATE

Adverse reactions and laboratory abnormalities described below in Table 9 and Table 10 reflect exposure to IMBRUVICA with a median duration of 8.6 months and exposure to ofatumumab with a median of 5.3 months in RESONATE in patients with previously treated CLL/SLL.

Table 9: Adverse Reactions Reported in ≥ 10% of Patients in the IMBRUVICA Treated Arm in Patients with CLL/SLL in RESONATE

Body System Adverse Reaction	IMBRUVICA (N=195)		Ofatumumab (N=191)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
Gastrointestinal disorders				
Diarrhea	48	4	18	2
Nausea	26	2	18	0
Stomatitis*	17	1	6	1
Constipation	15	0	9	0
Vomiting	14	0	6	1
Musculoskeletal and connective tissue disorders				
Musculoskeletal pain*	28	2	18	1
Arthralgia	17	1	7	0
Muscle spasms	13	0	8	0
Skin and subcutaneous tissue disorders				
Rash*	24	3	13	0
Petechiae	14	0	1	0
Bruising*	12	0	1	0
General disorders and administration site conditions				
Pyrexia	24	2	15	2[†]
Respiratory, thoracic and mediastinal disorders				

Body System Adverse Reaction	IMBRUVICA (N=195)		Ofatumumab (N=191)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
Cough	19	0	23	1
Dyspnea	12	2	10	1
Infections and infestations				
Upper respiratory tract infection	16	1	11	2†
Pneumonia*	15	12†	13	10†
Sinusitis*	11	1	6	0
Urinary tract infection	10	4	5	1
Nervous system disorders				
Headache	14	1	6	0
Dizziness	11	0	5	0
Injury, poisoning and procedural complications				
Contusion	11	0	3	0
Eye disorders				
Vision blurred	10	0	3	0

The body system and individual ADR terms are sorted in descending frequency order in the IMBRUVICA arm.
* Includes multiple ADR terms
† Includes 3 events of pneumonia with fatal outcome in each arm, and 1 event of pyrexia and upper respiratory tract infection with a fatal outcome in the ofatumumab arm.

Table 10: Treatment-Emergent Hematologic Laboratory Abnormalities in Patients with CLL/SLL in RESONATE

	IMBRUVICA (N=195)		Ofatumumab (N=191)	
	All Grades (%)	Grade 3 or 4 (%)	All Grades (%)	Grade 3 or 4 (%)
Neutrophils decreased	51	23	57	26
Platelets decreased	52	5	45	10
Hemoglobin decreased	36	0	21	0

Treatment-emergent Grade 4 thrombocytopenia (2% in the IMBRUVICA arm vs 3% in the ofatumumab arm) and neutropenia (8% in the IMBRUVICA arm vs 8% in the ofatumumab arm) occurred in patients.

RESONATE-2

Adverse reactions and laboratory abnormalities described below in Table 11 and Table 12 reflect exposure to IMBRUVICA with a median duration of 17.4 months. The median exposure to chlorambucil was 7.1 months in RESONATE-2.

Table 11: Adverse Reactions Reported in ⩾ 10% of Patients in the IMBRUVICA Treated Arm in Patients with CLL/SLL in RESONATE-2

Body System Adverse Reaction	IMBRUVICA (N=135)		Chlorambucil (N=132)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
Gastrointestinal disorders				
Diarrhea	42	4	17	0
Nausea	22	1	39	1
Constipation	16	1	16	0
Stomatitis*	14	1	4	1
Vomiting	13	0	20	1
Abdominal pain	13	3	11	1
Dyspepsia	11	0	2	0
Musculoskeletal and connective tissue disorders				
Musculoskeletal pain*	36	4	20	0
Arthralgia	16	1	7	1
Muscle spasms	11	0	5	0
General disorders and administration site conditions				
Fatigue	30	1	38	5
Peripheral edema	19	1	9	0
Pyrexia	17	0	14	2
Respiratory, thoracic and mediastinal disorders				
Cough	22	0	15	0
Dyspnea	10	1	10	0
Skin and subcutaneous tissue disorders				
Rash*	21	4	12	2
Bruising*	19	0	7	0
Eye disorders				
Dry eye	17	0	5	0
Lacrimation increased	13	0	6	0
Vision blurred	13	0	8	0
Visual acuity reduced	11	0	2	0
Infections and infestations				
Upper respiratory tract infection	17	2	17	2
Skin infection*	15	2	3	1
Pneumonia*	14	8	7	4
Urinary tract infections	10	1	8	1
Vascular disorders				
Hypertension*	14	4	1	0

Body System Adverse Reaction	IMBRUVICA (N=135)		Chlorambucil (N=132)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
Nervous system disorders				
Headache	12	1	10	2
Dizziness	11	0	12	1
Investigations				
Weight decreased	10	0	12	0

Subjects with multiple events for a given ADR term are counted once only for each ADR term.
The body system and individual ADR terms are sorted in descending frequency order in the IMBRUVICA arm.
* Includes multiple ADR terms

Table 12: Treatment-Emergent Hematologic Laboratory Abnormalities in Patients with CLL/SLL in RESONATE-2

	IMBRUVICA (N=135)		Chlorambucil (N=132)	
	All Grades (%)	Grade 3 or 4 (%)	All Grades (%)	Grade 3 or 4 (%)
Neutrophils Decreased	55	28	67	31
Platelets Decreased	47	7	58	14
Hemoglobin Decreased	36	0	39	2

Treatment-emergent Grade 4 thrombocytopenia (1% in the IMBRUVICA arm vs 3% in the chlorambucil arm) and neutropenia (11% in the IMBRUVICA arm vs 12% in the chlorambucil arm) occurred in patients.

HELIOS

Adverse reactions described below in Table 13 reflect exposure to IMBRUVICA + BR with a median duration of 14.7 months and exposure to placebo + BR with a median of 12.8 months in HELIOS in patients with previously treated CLL/SLL.

Table 13: Adverse Reactions Reported in ≥ 10% of Patients and ≥ 2% Greater in the IMBRUVICA Arm in Patients with CLL/SLL in HELIOS

Body System Adverse Reaction	IMBRUVICA + BR (N=287)		Placebo + BR (N=287)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
Blood and lymphatic system disorders				
Neutropenia*	66	61	60	56[†]
Thrombocytopenia*	34	16	26	16
Gastrointestinal disorders				
Diarrhea	36	2	23	1
Abdominal pain	12	1	8	<1

Body System Adverse Reaction	IMBRUVICA + BR (N=287)		Placebo + BR (N=287)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
Skin and subcutaneous tissue disorders				
Rash *	32	4	25	1
Bruising *	20	<1	8	<1
Musculoskeletal and connective tissue disorders				
Musculoskeletal pain*	29	2	20	0
Muscle spasms	12	<1	5	0
General disorders and administration site conditions				
Pyrexia	25	4	22	2
Vascular disorders				
Hemorrhage*	19	2†	9	1
Hypertension *	11	5	5	2
Infections and infestations				
Bronchitis	13	2	10	3
Skin infection*	10	3	6	2
Metabolism and nutrition disorders				
Hyperuricemia	10	2	6	0

The body system and individual ADR terms are sorted in descending frequency order in the IMBRUVICA arm.
* Includes multiple ADR terms
<1 used for frequency above 0 and below 0.5%
† Includes 2 events of hemorrhage with fatal outcome in the IMBRUVICA arm and 1 event of neutropenia with a fatal outcome in the placebo + BR arm.

Atrial fibrillation of any grade occurred in 7% of patients treated with IMBRUVICA + BR and 2% of patients treated with placebo + BR. The frequency of Grade 3 and 4 atrial fibrillation was 3% in patients treated with IMBRUVICA + BR and 1% in patients treated with placebo + BR.

iLLUMINATE

Adverse reactions described below in Table 14 reflect exposure to IMBRUVICA + obinutuzumab with a median duration of 29.3 months and exposure to chlorambucil + obinutuzumab with a median of 5.1 months in iLLUMINATE in patients with previously untreated CLL/SLL.

Table 14: Adverse Reactions Reported in ≥ 10% of Patients in the IMBRUVICA Arm in Patients with CLL/SLL in iLLUMINATE

Body System Adverse Reaction	IMBRUVICA + Obinutuzumab (N=113)		Chlorambucil + Obinutuzumab (N=115)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
Blood and lymphatic system disorders				
Neutropenia*	48	39	64	48
Thrombocytopenia*	36	19	28	11
Anemia	17	4	25	8
Skin and subcutaneous tissue disorders				
Rash*	36	3	11	0
Bruising*	32	3	3	0
Gastrointestinal disorders				
Diarrhea	34	3	10	0
Constipation	16	0	12	1
Nausea	12	0	30	0
Musculoskeletal and connective tissue disorders				
Musculoskeletal pain*	33	1	23	3
Arthralgia	22	1	10	0
Muscle spasms	13	0	6	0
Respiratory, thoracic and mediastinal disorders				
Cough	27	1	12	0
Injury, poisoning and procedural complications				
Infusion related reaction	25	2	58	8
Vascular disorders				
Hemorrhage*	25	1	9	0
Hypertension*	17	4	4	3
General disorders and administration site conditions				
Pyrexia	19	2	26	1
Fatigue	18	0	17	2
Peripheral edema	12	0	7	0
Infections and infestations				
Pneumonia*	16	9	9	4[†]
Upper respiratory tract infection	14	1	6	0
Skin infection*	13	1	3	0

Body System Adverse Reaction	IMBRUVICA + Obinutuzumab (N=113)		Chlorambucil + Obinutuzumab (N=115)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
Urinary tract infection	12	3	7	1
Nasopharyngitis	12	0	3	0
Conjunctivitis	11	0	2	0
Metabolism and nutrition disorders				
Hyperuricemia	13	1	0	0
Cardiac disorders				
Atrial fibrillation	12	5	0	0
Psychiatric disorders				
Insomnia	12	0	4	0

The body system and individual ADR terms are sorted in descending frequency order in the IMBRUVICA arm.
* Includes multiple ADR terms
† Includes one event with a fatal outcome.

E1912

Adverse reactions described below in Table 15 reflect exposure to IMBRUVICA + rituximab with a median duration of 34.3 months and exposure to FCR with a median of 4.7 months in E1912 in patients with previously untreated CLL/SLL who were 70 years or younger.

Table 15: Adverse Reactions Reported in ≥ 15% of Patients in the IMBRUVICA Arm in Patients with CLL/SLL in E1912

Body System Adverse Reaction	IMBRUVICA + Rituximab (N=352)		Fludarabine + Cyclophosphamide + Rituximab (N=158)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
General disorders and administration site conditions				
Fatigue	80	2	78	3
Peripheral edema	28	1	17	0
Pyrexia	27	1	27	1
Pain	23	2	8	0
Musculoskeletal and connective tissue disorders				
Musculoskeletal pain*	61	5	35	2
Arthralgia	41	5	10	1
Gastrointestinal disorders				
Diarrhea	53	4	27	1
Nausea	40	1	64	1

Body System Adverse Reaction	IMBRUVICA + Rituximab (N=352)		Fludarabine + Cyclophosphamide + Rituximab (N=158)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
Stomatitis*	22	1	8	1
Abdominal pain*	19	2	10	1
Vomiting	18	2	28	0
Constipation	17	0	32	0
Skin and subcutaneous tissue disorders				
Rash*	49	4	29	5
Bruising*	36	1	4	1
Vascular disorders				
Hypertension*	42	19	22	6
Hemorrhage*	31	2	8	1
Nervous system disorders				
Headache	40	1	27	1
Dizziness	21	1	13	1
Peripheral neuropathy*	19	1	13	1
Respiratory, thoracic and mediastinal disorders				
Cough	32	0	25	0
Dyspnea	22	2	21	1
Infections and infestations				
Upper respiratory tract infection	29	1	19	2
Skin infection*	16	1	3	1
Metabolism and nutrition disorders				
Hyperuricemia	19	1	4	0
Decreased appetite	15	0	20	1
Psychiatric disorders				
Insomnia	16	1	19	1

The body system and individual ADR terms are sorted in descending frequency order in the IMBRUVICA arm.

* Includes multiple ADR terms

Table 16: Select Laboratory Abnormalities (≥ 15% Any Grade), New or Worsening from Baseline in Patients Receiving IMBRUVICA (E1912)

	IMBRUVICA + Rituximab (N=352)		Fludarabine + Cyclophosphamide + Rituximab (N=158)	
	All Grades (%)	Grade 3 or 4 (%)	All Grades (%)	Grade 3 or 4 (%)
Hematology abnormalities				

Neutrophils decreased	53	30	70	44
Platelets decreased	43	7	69	25
Hemoglobin decreased	26	0	51	2
Chemistry abnormalities				
Creatinine increased	38	1	17	1
Bilirubin increased	30	2	15	0
AST increased	25	3	23	<1

Based on laboratory measurements per IWCLL criteria

PCYC-1142-CA

Adverse reactions and laboratory abnormalities described below in Tables 17 and Table 18 reflect exposure to IMBRUVICA in combination with venetoclax with a median duration of 14.1 months in patients with previously untreated CLL/SLL who were 70 years or younger in Study PCYC-1142-CA.[i]

Table 17: Adverse reactions reported in at least 15% patient previously untreated with CLL/SLL in Study PCYC-1142-CA[ii]

System Organ Class Adverse Reaction Term	**IMBRUVICA + Venetoclax (N=323) (%)**	
	All Grades	**Grade 3 or 4**
Gastrointestinal disorders		
Diarrhea	67	4
Nausea	44	1
Stomatitis*	30	1
Abdominal pain*	24	1
Vomiting	22	1
Dyspepsia	18	0
Constipation	16	0
General disorders and administration site conditions		
Fatigue	26	2
Infections and infestations		
Upper respiratory tract infection	26	0
Skin infection*	20	2
Musculoskeletal and connective tissue disorders		
Musculoskeletal pain*	41	1
Arthralgia	34	2
Muscle spasms	24	0
Nervous system disorders		
Headache	27	1
Dizziness	16	0
Respiratory, thoracic and mediastinal disorders		

Cough	17	0
Skin and subcutaneous tissue disorders		
Bruising*	47	0
Rash*	38	3
Vascular disorders		
Hemorrhage*	33	1
Hypertension*	16	7

Pooled safety data is from the Fixed Duration (FD) cohort and first 16 cycles of the Minimal Residual Disease (MRD) cohort.

The body system and individual ADR terms are sorted in descending frequency order in the IMBRUVICA arm.

* Includes multiple adverse reaction terms

Table 18: Select Laboratory Abnormalities (≥20% Any Grade), New or Worsening from Baseline in patients with CLL/SLL treated with IMBRUVICA in combination with venetoclax in Study PCYC-1142-CA[iii,iv]

	IMBRUVICA + venetoclax (N=323) (%)	
	All Grades	**Grade 3 or 4**
Hematology abnormalities*		
Neutrophils decreased	72	37
Platelets decreased	60	11
Hemoglobin decreased	22	<1
Chemistry abnormalities		
Hypernatremia	43	0
Hypocalcemia	38	<1
Hypomagnesemia	32	1
Bilirubin increased	28	3
Hyperkalemia	26	2
Hyperuricemia	26	26
AST increased	23	2
ALP increased	22	<1
ALT increased	20	2
Creatinine increased	20	0

* Based on laboratory measurements per iwCLL criteria grade (iwCLL: International Workshop on Chronic Lymphocytic. Leukemia)

<1 used for frequency above 0 and below 0.5%

CLL3011

Adverse reactions and laboratory abnormalities described below in Tables 19 and 20 reflect exposure to IMBRUVICA + venetoclax with a median duration of 13.8 months and exposure to chlorambucil + obinutuzumab with a median of

5.1 months in Study CLL3011 in patients with previously untreated CLL/SLL who were 65 years or older, or adult patients <65 years of age with a CIRS score >6 or CrCL <70 mL/min. [v]

Table 19: Adverse reactions reported in at least 15% of Patients in the IMBRUVICA arm in Patients with CLL/SLL in Study CLL3011[vi]

System Organ Class Adverse Reaction Term	IMBRUVICA + Venetoclax (N=106) (%)		Chlorambucil + Obinutuzumab (N=105) (%)	
	All Grades	Grade 3 or 4	All Grades	Grade 3 or 4
Gastrointestinal disorders				
Diarrhea	51	10	12	1
Nausea	26	0	26	0
Stomatitis*	15	0	3	0
Skin and subcutaneous tissue disorders				
Rash*	28	7	14	1
Bruising*	23	1	3	0
Musculoskeletal and connective tissue disorders				
Musculoskeletal pain*	24	3	17	0
Vascular disorders				
Hemorrhage*	23	4	5	1
Infections and infestations				
Urinary tract infection	16	2	5	2
General disorders and administration site conditions				
Peripheral edema	15	0	3	0
Fatigue	15	1	10	0

* Includes multiple adverse reaction terms

Table 20: Select Laboratory Abnormalities (≥20% Any Grade), New or Worsening from Baseline in previously untreated patients with CLL/SLL in Study CLL3011[vii,viii]

	IMBRUVICA + venetoclax (N=106) (%)		Chlorambucil + Obinutuzumab (N=105) (%)	
	All Grades	Grade 3 or 4	All Grades	Grade 3 or 4
Hematology abnormalities*				
Neutrophils decreased	76	42	90	54
Platelets decreased	49	13	74	31
Hemoglobin decreased	36	0	40	0
Chemistry abnormalities				
Hypocalcemia	25	0	29	0
Bilirubin increased	34	2	24	1

Hyperkalemia	29	2	21	1
Hyperuricemia	35	8	18	5
AST increased	22	2	29	3
ALT increased	21	3	25	3
Creatinine increased	31	1	16	0
Creatinine clearance decreased	38	5	16	1
Hypoalbuminemia	34	0	19	2
Hypokalemia	24	3	9	0
Hyponatremia	24	8	25	1

* Based on laboratory measurements per iwCLL criteria grade (iwCLL: International Workshop on Chronic Lymphocytic. Leukemia)

Waldenström's Macroglobulinemia and Marginal Zone Lymphoma

The data described below reflect exposure to IMBRUVICA in three single-arm open-label clinical trials (Study 1118, Study 1121, and INNOVATE monotherapy arm) and one randomized controlled trial (INNOVATE) in patients with WM or MZL, including a total n=307 patients overall and n=232 patients exposed to IMBRUVICA. Study 1118 included 63 patients with previously treated WM who received single agent IMBRUVICA. Study 1121 included 63 patients with previously treated MZL who received single agent IMBRUVICA. INNOVATE included 150 patients with treatment naïve or previously treated WM who received IMBRUVICA or placebo in combination with rituximab. The INNOVATE monotherapy arm included 31 patients with previously treated WM who failed prior rituximab-containing therapy and received IMBRUVICA.

The most common adverse reactions in Studies 1118, 1121, and INNOVATE (≥ 20%) were thrombocytopenia, diarrhea, bruising, neutropenia, musculoskeletal pain, hemorrhage, anemia, rash, fatigue, and nausea.

Seven percent of patients receiving IMBRUVICA across Studies 1118, 1121, and INNOVATE discontinued treatment due to adverse reactions. The most common adverse reactions leading to discontinuation were atrial fibrillation, interstitial lung disease, diarrhea and rash. Adverse reactions leading to dose reduction occurred in 13% of patients.

Study 1118 and INNOVATE Monotherapy Arm

Adverse reactions and laboratory abnormalities described below in Table 21 and Table 22 reflect exposure to IMBRUVICA with a median duration of 11.7 months in Study 1118 and 33 months in the INNOVATE Monotherapy Arm.

Table 21: Non-Hematologic Adverse Reactions in ≥ 10% in Patients with WM in Study 1118 and the INNOVATE Monotherapy Arm (N=94)

Body System	Adverse Reaction	All Grades (%)	Grade 3 or Higher (%)
Gastrointestinal disorders	Diarrhea	38	2
	Nausea	21	0

Body System	Adverse Reaction	All Grades (%)	Grade 3 or Higher (%)
	Stomatitis*	15	0
	Constipation	12	1
	Gastroesophageal reflux disease	12	0
Skin and subcutaneous tissue disorders	Bruising*	28	1
	Rash*	21	1
Vascular disorders	Hemorrhage*	28	0
	Hypertension*	14	4
General disorders and administrative site conditions	Fatigue	18	2
	Pyrexia	12	2
Musculoskeletal and connective tissue disorders	Musculoskeletal pain*	21	0
	Muscle spasms	19	0
Infections and infestations	Upper respiratory tract infection	19	0
	Skin infection*	18	3
	Sinusitis*	16	0
	Pneumonia*	13	5
Nervous system disorders	Headache	14	0
	Dizziness	13	0
Respiratory, thoracic and mediastinal disorders	Cough	13	0

The body system and individual ADR preferred terms are sorted in descending frequency order.
* Includes multiple ADR terms.

Table 22: Treatment-Emergent Hematologic Laboratory Abnormalities in Patients with WM in Study 1118 and the INNOVATE Monotherapy Arm (N=94)

	Percent of Patients (N=94)	
	All Grades (%)	Grade 3 or 4 (%)
Platelets Decreased	38	11
Neutrophils Decreased	43	16
Hemoglobin Decreased	21	6

Treatment-emergent Grade 4 thrombocytopenia (4%) and neutropenia (7%) occurred in patients.

INNOVATE

Adverse reactions described below in Table 23 reflect exposure to IMBRUVICA + R with a median duration of 25.8 months and exposure to placebo + R with a median duration of 15.5 months in patients with treatment naïve or previously treated WM in INNOVATE.

Table 23: Adverse Reactions Reported in ≥ 10% of Patients and ≥ 2% Greater in the IMBRUVICA Arm in Patients with WM in INNOVATE

Body System Adverse Reaction	IMBRUVICA + R (N=75)		Placebo + R (N=75)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
Skin and subcutaneous tissue disorders				
Bruising*	37	1	5	0
Rash*	24	1	11	0
Musculoskeletal and connective tissue disorders				
Musculoskeletal pain*	35	4	21	3
Arthralgia	24	3	11	1
Muscle spasms	17	0	12	1
Vascular disorders				
Hemorrhage*	32	3	17	4[†]
Hypertension*	20	13	5	4
Gastrointestinal disorders				
Diarrhea	28	0	15	1
Nausea	21	0	12	0
Dyspepsia	16	0	1	0
Constipation	13	1	11	1
Infections and infestations				
Pneumonia*	19	13	5	3
Skin infection*	17	3	3	0
Urinary tract infection	13	0	0	0
Bronchitis	12	3	7	0
Influenza	12	0	7	1
Viral upper respiratory tract infection	11	0	7	0
General disorders and administration site conditions				
Peripheral edema	17	0	12	1
Respiratory, thoracic, and mediastinal disorders				
Cough	17	0	11	0
Blood and lymphatic system disorders				
Neutropenia*	16	12	11	4
Cardiac disorders				
Atrial fibrillation	15	12	3	1

Body System Adverse Reaction	IMBRUVICA + R (N=75)		Placebo + R (N=75)	
	All Grades (%)	Grade 3 or Higher (%)	All Grades (%)	Grade 3 or Higher (%)
Nervous system disorders				
Dizziness	11	0	7	0
Psychiatric disorders				
Insomnia	11	0	4	0
Metabolism and nutrition disorders				
Hypokalemia	11	0	1	1

The body system and individual ADR preferred terms are sorted in descending frequency order.
* Includes multiple ADR terms.
† Includes one event with a fatal outcome.

Grade 3 or 4 infusion related reactions were observed in 1% of patients treated with IR.

Study 1121

Adverse reactions and laboratory abnormalities described below in Table 24 and Table 25 reflect exposure to IMBRUVICA with a median duration of 11.6 months in Study 1121.

Table 24: Non-Hematologic Adverse Reactions in ≥ 10% in Patients with MZL in Study 1121 (N=63)

Body System	Adverse Reaction	All Grades (%)	Grade 3 or Higher (%)
General disorders and administrative site conditions	Fatigue	44	6
	Peripheral edema	24	2
	Pyrexia	17	2
Gastrointestinal disorders	Diarrhea	43	5
	Nausea	25	0
	Dyspepsia	19	0
	Stomatitis*	17	2
	Abdominal pain	16	2
	Constipation	14	0
	Abdominal pain upper	13	0
	Vomiting	11	2
Skin and subcutaneous tissue disorders	Bruising *	41	0
	Rash*	29	5
	Pruritus	14	0
Musculoskeletal and connective tissue disorders	Musculoskeletal pain*	40	3
	Arthralgia	24	2
	Muscle spasms	19	3
Infections and infestations	Upper respiratory tract infection	21	0
	Sinusitis*	19	0
	Bronchitis	11	0
	Pneumonia*	11	10

Body System	Adverse Reaction	All Grades (%)	Grade 3 or Higher (%)
Metabolism and nutrition disorders	Decreased appetite	16	2
	Hyperuricemia	16	0
	Hypoalbuminemia	14	0
	Hypokalemia	13	0
Vascular disorders	Hemorrhage*	30	2†
	Hypertension*	14	5
Respiratory, thoracic and mediastinal disorders	Cough	22	2
	Dyspnea	21	2
Nervous system disorders	Dizziness	19	0
	Headache	13	0
Psychiatric disorders	Anxiety	16	2

The body system and individual ADR preferred terms are sorted in descending frequency order.
* Includes multiple ADR terms.
† Includes one event with a fatal outcome.

Table 25: Treatment-Emergent Hematologic Laboratory Abnormalities in Patients with MZL in Study 1121 (N=63)

	Percent of Patients (N=63)	
	All Grades (%)	Grade 3 or 4 (%)
Platelets decreased	49	6
Hemoglobin decreased	43	13
Neutrophils decreased	22	13

Treatment-emergent Grade 4 thrombocytopenia (3%) and neutropenia (6%) occurred in patients.

Chronic Graft versus Host Disease

Study 1129

The data described below reflect exposure to IMBRUVICA in an open-label clinical trial (Study 1129) that included 42 patients with cGVHD after failure of first line corticosteroid therapy and required additional therapy *[see Clinical Studies (14.3)]*.

The most common adverse reactions in the cGVHD trial (≥ 20%) were fatigue, bruising, diarrhea, thrombocytopenia, stomatitis, muscle spasms, nausea, hemorrhage, anemia, and pneumonia. Atrial fibrillation occurred in one patient (2%) which was Grade 3.

Twenty-four percent of patients receiving IMBRUVICA in the cGVHD trial discontinued treatment due to adverse reactions. The most common adverse reactions leading to discontinuation were fatigue and pneumonia. Adverse reactions leading to dose reduction occurred in 26% of patients.

Adverse reactions and laboratory abnormalities described below in Table 26 and Table 27 reflect exposure to IMBRUVICA with a median duration of 4.4 months in Study 1129 .

Table 26: Non-Hematologic Adverse Reactions in ≥ 10% of Patients with cGVHD in Study 1129 (N=42)

Body System	Adverse Reaction	All Grades (%)	Grade 3 or Higher (%)
General disorders and administration site conditions	Fatigue	57	12
	Pyrexia	17	5
	Edema peripheral	12	0
Skin and subcutaneous tissue disorders	Bruising*	40	0
	Rash*	12	0
Gastrointestinal disorders	Diarrhea	36	10
	Stomatitis*	29	2
	Nausea	26	0
	Constipation	12	0
Musculoskeletal and connective tissue disorders	Muscle spasms	29	2
	Musculoskeletal pain*	14	5
Vascular disorders	Hemorrhage*	26	0
Infections and infestations	Pneumonia*	21	14†
	Upper respiratory tract infection	19	0
	Sepsis*	10	10
Nervous system disorders	Headache	17	5
Injury, poisoning and procedural complications	Fall	17	0
Respiratory, thoracic and mediastinal disorders	Cough	14	0
	Dyspnea	12	2
Metabolism and nutrition disorders	Hypokalemia	12	7

The system organ class and individual ADR preferred terms are sorted in descending frequency order.
* Includes multiple ADR terms.
† Includes 2 events with a fatal outcome.

Table 27: Treatment-Emergent Hematologic Laboratory Abnormalities in Patients with cGVHD in Study 1129 (N=42)

	Percent of Patients (N=42)	
	All Grades (%)	Grade 3 or 4 (%)
Platelets decreased	33	0
Neutrophils decreased	10	10
Hemoglobin decreased	24	2

Treatment-emergent Grade 4 neutropenia occurred in 2% of patients.

Additional Important Adverse Reactions

Cardiovascular Events

Data on cardiovascular events are based on randomized controlled trials with IMBRUVICA (n=2,115; median treatment duration of 19.1 months for 1,157 patients treated with IMBRUVICA and 5.3 months for 958 patients in the control arm). The incidence of ventricular tachyarrhythmias (ventricular extrasystoles, ventricular arrhythmias, ventricular fibrillation, ventricular flutter, and ventricular tachycardia) of any grade was 1.0%

versus 0.4% and of Grade 3 or greater was 0.3% versus 0% in patients treated with IMBRUVICA compared to patients in the control arm. The incidence of atrial fibrillation and atrial flutter of any grade was 8.4% versus 1.6% and for Grade 3 or greater was 4.0% versus 0.5% in patients treated with IMBRUVICA compared to patients in the control arm. In addition, the incidence of cardiac failure of any grade was 1.7% versus 0.5% and for Grade 3 or greater was 1.2% versus 0.3% in patients treated with IMBRUVICA compared to patients in the control arm.

The incidence of ischemic cerebrovascular events (cerebrovascular accidents, ischemic stroke, cerebral ischemia, and transient ischemic attack) of any grade was 1% versus 0.4% and Grade 3 or greater was 0.5% versus 0.2% in patients treated with IMBRUVICA compared to patients in the control arm, respectively.

Diarrhea

In randomized controlled trials (n=2,115; median treatment duration of 19.1 months for 1,157 patients treated with IMBRUVICA and 5.3 months for 958 patients in the control arm), diarrhea of any grade occurred at a rate of 43% of patients treated with IMBRUVICA compared to 19% of patients in the control arm. Grade 3 diarrhea occurred in 3% versus 1% of IMBRUVICA-treated patients compared to the control arm, respectively. Less than 1% (0.3%) of subjects discontinued IMBRUVICA due to diarrhea compared with 0% in the control arm.

Based on data from 1,605 of these patients, the median time to first onset was 21 days (range, 0 to 708) versus 46 days (range, 0 to 492) for any grade diarrhea and 117 days (range, 3 to 414) versus 194 days (range, 11 to 325) for Grade 3 diarrhea in IMBRUVICA-treated patients compared to the control arm, respectively. Of the patients who reported diarrhea, 85% versus 89% had complete resolution, and 15% versus 11% had not reported resolution at time of analysis in IMBRUVICA-treated patients compared to the control arm, respectively. The median time from onset to resolution in IMBRUVICA-treated subjects was 7 days (range, 1 to 655) versus 4 days (range, 1 to 367) for any grade diarrhea and 7 days (range, 1 to 78) versus 19 days (range, 1 to 56) for Grade 3 diarrhea in IMBRUVICA-treated subjects compared to the control arm, respectively.

Visual Disturbance

In randomized controlled trials (n=2,115; median treatment duration of 19.1 months for 1,157 patients treated with IMBRUVICA and 5.3 months for 958 patients in the control arm), blurred vision and decreased visual acuity of any grade occurred in 11% of patients treated with IMBRUVICA (9% Grade 1, 2% Grade 2, no Grade 3 or higher) compared to 6% in the control arm (5% Grade 1 and <1% Grade 2 and 3).

Based on data from 1,605 of these patients, the median time to first onset was 91 days (range, 0 to 617) versus 100 days (range, 2 to 477) in IMBRUVICA-treated patients compared to the control arm, respectively. Of the patients who reported visual disturbances, 60% versus 71% had complete resolution and 40% versus 29% had not reported resolution at the time of analysis in IMBRUVICA-treated patients compared to the control arm, respectively. The median time from onset to resolution was 37 days (range, 1 to 457) versus 26 days (range, 1 to 721) in IMBRUVICA-treated subjects compared to the control arm, respectively.

Long-Term Safety

The safety data from long-term treatment with IMBRUVICA over 5 years of 1,284 patients (treatment-naïve CLL/SLL n=162, relapsed/refractory CLL/SLL n=646, relapsed/refractory MCL n=370, and WM n=106) were analyzed. The median treatment duration was 51 months (range, 0.2 to 98 months) for CLL/SLL, 11 months (range, 0 to 87 months) for MCL, and 47 months (range, 0.3 to 61 months) for WM. The cumulative rate of

hypertension increased over time. The prevalence for Grade 3 or greater hypertension was 4% (year 0-1), 7% (year 1-2), 9% (year 2-3), 9% (year 3-4), and 9% (year 4-5); the overall incidence for the 5-year period was 11%.

9.2 Postmarketing Experience

The following adverse reactions have been identified during postapproval use of IMBRUVICA. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

- Hepatobiliary disorders: hepatic failure including acute and/or fatal events, hepatic cirrhosis, , drug-induced liver injury
- Respiratory disorders: interstitial lung disease
- Metabolic and nutrition disorders: tumor lysis syndrome
- Immune system disorders: anaphylactic shock, angioedema, urticaria
- Skin and subcutaneous tissue disorders: Stevens-Johnson Syndrome (SJS), onychoclasis, panniculitis, neutrophilic dermatoses, cutaneous vasculitis
- Infections: hepatitis B reactivation
- Nervous system disorders: peripheral neuropathy
- Eye disorders: Eye hemorrage, uveitis

Reporting of suspected adverse reactions
Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product.Any suspected adverse events should be reported to the Ministry of Health according to the National Regulation by using an online form http://sideeffects.health.gov.il

10 DRUG INTERACTIONS

10.1 Effect of CYP3A Inhibitors on Ibrutinib

The coadministration of IMBRUVICA with a strong or moderate CYP3A inhibitor may increase ibrutinib plasma concentrations *[see Clinical Pharmacology (16.3)]*. Increased ibrutinib concentrations may increase the risk of drug-related toxicity.

Dose modifications of IMBRUVICA are recommended when used concomitantly with posaconazole, voriconazole and moderate CYP3A inhibitors *[see Dosage and Administration (5.3)]*.

Avoid concomitant use of other strong CYP3A inhibitors. Interrupt IMBRUVICA if these inhibitors will be used short-term (such as anti-infectives for seven days or less) *[see Dosage and Administration* (*5.3*)*]*.

Avoid grapefruit and Seville oranges during IMBRUVICA treatment, as these contain strong or moderate inhibitors of CYP3A.

10.2 Effect of CYP3A Inducers on Ibrutinib

The coadministration of IMBRUVICA with strong CYP3A inducers may decrease ibrutinib concentrations. Avoid coadministration with strong CYP3A inducers *[see Clinical Pharmacology (14.3)]*.

11 USE IN SPECIFIC POPULATIONS

11.1 Pregnancy

Risk Summary

IMBRUVICA can cause fetal harm based on findings from animal studies. There are no available data on IMBRUVICA use in pregnant women to inform a drug-associated risk of major birth defects and miscarriage. In animal reproduction studies, administration of ibrutinib to pregnant rats and rabbits during the period of organogenesis at exposures up to 2-20 times the clinical doses of 420-560 mg daily produced embryofetal toxicity including structural abnormalities *(see Data)*. Advise pregnant women of the potential risk to a fetus.

All pregnancies have a background risk of birth defect, loss, or other adverse outcomes. The estimated background risk of major birth defects and miscarriage for the indicated population is unknown. In the U.S. general population, the estimated background risk of major birth defects and miscarriage in clinically recognized pregnancies is 2-4% and 15-20%, respectively.

Data

Animal Data

Ibrutinib was administered orally to pregnant rats during the period of organogenesis at doses of 10, 40 and 80 mg/kg/day. Ibrutinib at a dose of 80 mg/kg/day was associated with visceral malformations (heart and major vessels) and increased resorptions and post-implantation loss. The dose of 80 mg/kg/day in rats is approximately 14 times the exposure (AUC) in patients with MCL or MZL and 20 times the exposure in patients with CLL/SLL or WM administered the dose of 560 mg daily and 420 mg daily, respectively. Ibrutinib at doses of 40 mg/kg/day or greater was associated with decreased fetal weights. The dose of 40 mg/kg/day in rats is approximately 6 times the exposure (AUC) in patients with MCL administered the dose of 560 mg daily.

Ibrutinib was also administered orally to pregnant rabbits during the period of organogenesis at doses of 5, 15, and 45 mg/kg/day. Ibrutinib at a dose of 15 mg/kg/day or greater was associated with skeletal variations (fused sternebrae) and ibrutinib at a dose of 45 mg/kg/day was associated with increased resorptions and post-implantation loss. The dose of 15 mg/kg/day in rabbits is approximately 2.0 times the exposure (AUC) in patients with MCL and 2.8 times the exposure in patients with CLL/SLL or WM administered the dose of 560 and 420 mg daily, respectively.

11.2 Lactation

Risk Summary

There is no information regarding the presence of ibrutinib or its metabolites in human milk, the effects on the breastfed child, or the effects on milk production. Because of the potential for serious adverse reactions in the breastfed child, advise women not to breastfeed during treatment with IMBRUVICA and for 1 week after the last dose.

11.3 Females and Males of Reproductive Potential

IMBRUVICA can cause fetal harm when administered to pregnant women *[see Use in Specific Populations (11.1)]*.

Pregnancy Testing

Verify pregnancy status in females of reproductive potential prior to initiating IMBRUVICA.

Contraception

Females

Advise females of reproductive potential to use effective contraception during treatment with IMBRUVICA and for up to 3 months after the last dose.

Males

Advise males with female partners of reproductive potential to use effective contraception during treatment with IMBRUVICA and for 3 months following the last dose.

Advise men to avoid fathering a child while receiving IMBRUVICA and for 3 months following

the last dose of IMBRUVICA.

11.4 Pediatric Use

The safety and effectiveness of IMBRUVICA in pediatric patients have not been established.

11.5 Geriatric Use

Of the 1,124 patients in clinical studies of IMBRUVICA, 64% were ≥ 65 years of age, while 23% were ≥75 years of age. No overall differences in effectiveness were observed between younger and older patients. Anemia (all grades), pneumonia (Grade 3 or higher), thrombocytopenia, hypertension, and atrial fibrillation occurred more frequently among older patients treated with IMBRUVICA.

11.6 Hepatic Impairment

Avoid use of IMBRUVICA in patients with severe hepatic impairment (Child-Pugh class C). The safety of IMBRUVICA has not been evaluated in patients with mild to severe hepatic impairment by Child-Pugh criteria.

Reduce the recommended dose when administering IMBRUVICA to patients with mild or moderate hepatic impairment (Child-Pugh class A and B). Monitor patients more frequently for adverse reactions of IMBRUVICA *[see Dosage and Administration (5.4), Clinical Pharmacology (14.3)]*.

11.7 Plasmapheresis

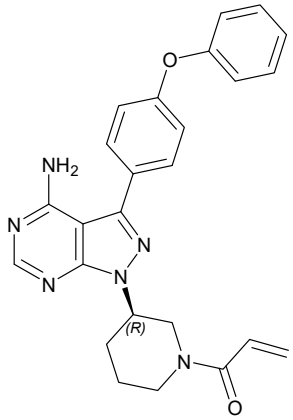
Management of hyperviscosity in WM patients may include plasmapheresis before and during treatment with IMBRUVICA. Modifications to IMBRUVICA dosing are not required.

12 OVERDOSAGE

There is no specific experience in the management of ibrutinib overdose in patients. One healthy subject experienced reversible Grade 4 hepatic enzyme increases (AST and ALT) after a dose of 1680 mg. Closely monitor patients who ingest more than the recommended dosage and provide appropriate supportive treatment.

13 DESCRIPTION

Ibrutinib is kinase inhibitor. It is a white to off-white solid with the empirical formula $C_{25}H_{24}N_6O_2$ and a molecular weight 440.50. Ibrutinib is freely soluble in dimethyl sulfoxide, soluble in methanol and practically insoluble in water. The chemical name for ibrutinib is 1-[(3R)-3-[4-amino-3-(4-phenoxyphenyl)-1H-pyrazolo[3,4-d]pyrimidin-1-yl]-1-piperidinyl]-2-propen-1-one and has the following structure:



IMBRUVICA (ibrutinib) is available as immediate-release oral capsules and immediate-release oral tablets.

IMBRUVICA (ibrutinib) capsules for oral use are supplied as white opaque capsules that contain 140 mg. Each capsule contains ibrutinib (active ingredient) and the following inactive ingredients: croscarmellose sodium, magnesium stearate, microcrystalline cellulose, sodium lauryl sulfate. The capsule shell contains gelatin, titanium dioxide and black ink.

IMBRUVICA (ibrutinib) tablets for oral use are available in the following dosage strengths: 140 mg, 280 mg, 420 mg, and 560 mg. Each tablet contains ibrutinib (active ingredient) and the following inactive ingredients: colloidal silicon dioxide, croscarmellose sodium, lactose monohydrate, magnesium stearate, microcrystalline cellulose, povidone, and sodium lauryl sulfate. The film coating for each tablet contains ferrosoferric oxide (140 mg, 280 mg, and 420 mg tablets), polyvinyl alcohol, polyethylene glycol, red iron oxide (280 mg and 560 mg tablets), talc, titanium dioxide, and yellow iron oxide (140 mg, 420 mg, and 560 mg tablets).

14 CLINICAL PHARMACOLOGY

14.1 Mechanism of Action

Ibrutinib is a small-molecule inhibitor of Bruton's tyrosine kinase (BTK). Ibrutinib forms a covalent bond with a cysteine residue in the BTK active site, leading to inhibition of BTK enzymatic activity. BTK is a signaling molecule of the B-cell antigen receptor (BCR) and cytokine receptor pathways. BTK's role in signaling through the B-cell surface receptors results in activation of pathways necessary for B-cell trafficking, chemotaxis, and adhesion. Nonclinical studies show that ibrutinib inhibits malignant B-cell proliferation and survival *in vivo* as well as cell migration and substrate adhesion *in vitro*.

In preclinical tumour models, the combination of ibrutinib and venetoclax resulted in increased cellular apoptosis and anti-tumor activity compared to either agent alone. BTK inhibition by ibrutinib increases CLL cell dependence on BCL-2, a cell survival pathway, while venetoclax inhibits BCL-2 leading to apoptosis.

14.2 Pharmacodynamics

In patients with recurrent B-cell lymphoma > 90% occupancy of the BTK active site in peripheral blood mononuclear cells was observed up to 24 hours after ibrutinib doses of ≥ 2.5 mg/kg/day (≥ 175 mg/day for average weight of 70 kg).

In vitro Platelet Aggregation

Ibrutinib demonstrated inhibition of collagen-induced platelet aggregation, with IC50 values at 4.6 μM (2026 ng/mL), 0.8 μM (352 ng/mL), and 3 μM (1321 ng/mL) in blood samples from healthy donors, donors taking warfarin, and donors with severe renal dysfunction, respectively. Ibrutinib did not show meaningful inhibition of platelet aggregation for ADP, arachidonic acid, ristocetin, and TRAP-6.

Cardiac Electrophysiology

At a single dose 3 times the maximum recommended dose (1680 mg), IMBRUVICA did not prolong the QT interval to any clinically relevant extent.

14.3 Pharmacokinetics

Ibrutinib exposure increases with doses up to 840 mg (1.5 times the maximum approved recommended dosage) in patients with B-cell malignancies. The mean steady-state AUC (% coefficient of variation) observed in patients at 560 mg with MCL is 865 (69%) ng·h/mL and with MZL is 978 (82%) ng·h/mL, and in patients at 420 mg with CLL/SLL is 708 (71%) ng·h/mL, with WM is 707 (72%) ng·h/mL, and with cGVHD is 1159 (50%) ng·h/mL. Steady-state concentrations of ibrutinib without CYP3A inhibitors were achieved with an accumulation ratio of 1 to 1.6 after 1 week of multiple daily doses of 420 mg or 560 mg.

Absorption

Absolute bioavailability of ibrutinib in fasted condition was 2.9% (90% CI: 2.1, 3.9) in healthy subjects. Ibrutinib is absorbed after oral administration with a median T_{max} of 1 hour to 2 hours.

Effect of Food

The administration of IMBRUVICA with a high-fat and high-calorie meal (800 calories to 1,000 calories with approximately 50% of total caloric content of the meal from fat) increased ibrutinib C_{max} by 2- to 4-fold and AUC by approximately 2-fold, compared with administration of ibrutinib after overnight fasting.

In vitro studies suggest that ibrutinib is not a substrate of p-glycoprotein (P-gp) or breast cancer resistance protein (BCRP).

Distribution

Reversible binding of ibrutinib to human plasma protein *in vitro* was 97.3% with no concentration dependence in the range of 50 ng/mL to 1000 ng/mL. The volume of distribution (V_d) was 683 L, and the apparent volume of distribution at steady state ($V_{d,ss}/F$) was approximately 10,000 L.

Elimination

Intravenous clearance was 62 L/h in fasted conditions and 76 L/h in fed conditions. In line with the high first-pass effect, the apparent oral clearance is 2000 L/h in fasted conditions and 1000 L/h in fed conditions. The half-life of ibrutinib is 4 hours to 6 hours.

Metabolism

Metabolism is the main route of elimination for ibrutinib. It is metabolized to several metabolites primarily by cytochrome P450 (CYP) 3A and to a minor extent by CYP2D6. The active metabolite, PCI-45227, is a dihydrodiol metabolite with inhibitory activity towards BTK approximately 15 times lower than that of ibrutinib. The range of the mean metabolite to parent ratio for PCI-45227 at steady-state is 1 to 2.8.

Excretion

Ibrutinib, mainly in the form of metabolites, is eliminated primarily via feces. After a single oral administration of radiolabeled ibrutinib, 90% of radioactivity was excreted within 168 hours, with 80% excreted in the feces and less than 10% eliminated in urine. Unchanged ibrutinib accounted for 1% of the radiolabeled excreted dose in feces and none in urine, with the remainder of the excreted dose being metabolites.

Specific Populations

Age and Sex

Age and sex have no clinically meaningful effect on ibrutinib pharmacokinetics.

Patients with Renal Impairment

Mild and moderate renal impairment (creatinine clearance [CLcr] > 25 mL/min as estimated by Cockcroft-Gault equation) had no influence on the exposure of ibrutinib. No data is available in patients with severe renal impairment (CLcr < 25 mL/min) or in patients on dialysis.

Patients with Hepatic Impairment

The AUC of ibrutinib increased 2.7-fold in subjects with mild hepatic impairment (Child-Pugh class A), 8.2-fold in subjects with moderate hepatic impairment (Child-Pugh class B) and 9.8-fold in subjects with severe hepatic impairment (Child-Pugh class C) relative to subjects with normal liver function. The C_{max} of ibrutinib increased 5.2-fold in mild hepatic impairment, 8.8-fold in moderate hepatic impairment and 7-fold in severe hepatic impairment relative to subjects with normal liver function *[see Use in Specific Populations (11.6)]*.

Drug Interaction Studies

Clinical Studies and Model-Informed Approaches

Effect of CYP3A Inhibitors on Ibrutinib: The coadministration of multiple doses of ketoconazole (strong CYP3A inhibitor) increased the C_{max} of ibrutinib by 29-fold and AUC by 24-fold. The coadministration of multiple doses of voriconazole (strong CYP3A inhibitor) increased steady state C_{max} of ibrutinib by 6.7-fold and AUC by 5.7-fold. Simulations under fed conditions suggest that posaconazole (strong CYP3A inhibitor) may increase the AUC of ibrutinib 3-fold to 10-fold.

The coadministration of multiple doses of erythromycin (moderate CYP3A inhibitor) increased steady state C_{max} of ibrutinib by 3.4-fold and AUC by 3-fold.

Effect of CYP3A Inducers on Ibrutinib: The coadministration of rifampin (strong CYP3A inducer) decreased the C_{max} of ibrutinib by more than 13-fold and AUC by more than 10-fold. Simulations suggest that efavirenz (moderate CYP3A inducer) may decrease the AUC of ibrutinib by 3-fold.

In Vitro Studies

Effect of Ibrutinib on CYP Substrates: In vitro studies suggest that ibrutinib and PCI-45227 are unlikely to inhibit CYP1A2, 2B6, 2C8, 2C9, 2C19, 2D6 or 3A at clinical doses. Both ibrutinib and PCI-45227 are unlikely to induce CYP1A2, CYP2B6 or CYP3A at clinical doses.

Effect of Ibrutinib on Substrates of Transporters: In vitro studies suggest that ibrutinib may inhibit BCRP and P-gp transport at clinical doses. The coadministration of oral P-gp or BCRP substrates with a narrow therapeutic index (e.g., digoxin, methotrexate) with IMBRUVICA may increase their concentrations.

Agents that may have their plasma concentrations altered by ibrutinib

In studies of ibrutinib (420 mg) in combination with venetoclax (400 mg) in CLL patients, an increase in venetoclax exposure (approximately 1.8-fold based on AUC) was observed compared with monotherapy data for venetoclax.

15 NONCLINICAL TOXICOLOGY

15.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

Ibrutinib was not carcinogenic in a 6-month rasH2 mouse study at oral doses up to 2000 mg/kg/day resulting in exposures approximately 23 (males) to 37 (females) times higher than the exposure in humans at a dose of 560 mg daily *[see Warnings and Precautions (8.6)]*.

Ibrutinib was not mutagenic in a bacterial mutagenicity (Ames) assay, was not clastogenic in a chromosome aberration assay in mammalian (CHO) cells, nor was it clastogenic in an *in vivo* bone marrow micronucleus assay in mice at doses up to 2000 mg/kg.

Rats were administered oral daily doses of ibrutinib for 4 weeks prior to pairing and during pairing in males and 2 weeks prior to pairing and during pairing in females. Treatment of female rats continued following pregnancy up to gestation day (GD) 7, and treatment of male rats continued until end of study. No effects on fertility or reproductive capacities were observed in male or female rats up to the maximum dose tested, 100 mg/kg/day (Human Equivalent Dose [HED] 16 mg/kg).

16 CLINICAL STUDIES

16.1 Mantle Cell Lymphoma

Combination treatment in patients previously untreated for MCL who were eligible for autologous stem cell transplantation (ASCT)

The safety and efficacy of IMBRUVICA in patients with previously untreated MCL and who were eligible for autologous stem cell transplantation (ASCT) were evaluated in a randomised, phase 3, multi-centre, open-label, three arm study (TRIANGLE). The TRIANGLE study randomised 870 patients in a 1:1:1 ratio to receive either:

- IMBRUVICA Arm: IMBRUVICA 560 mg daily (Days 1-19) in combination with R-CHOP for three 21-day cycles (Cycles 1, 3, 5) alternating with three 21-day cycles of R-DHAP (Cycles 2, 4, 6) as induction therapy followed by 2 years IMBRUVICA 560 mg daily;
- IMBRUVICA + ASCT Arm: IMBRUVICA 560 mg daily (Days 1-19) in combination with R-CHOP for three 21-day cycles (Cycles 1, 3, 5) alternating with three 21-day cycles of R-DHAP (Cycles 2, 4, 6) as induction therapy followed by high-dose chemotherapy and ASCT followed by 2 years IMBRUVICA 560 mg daily;
- ASCT Arm: R-CHOP for three 21-day cycles (Cycles 1, 3, 5) alternating with three 21-day cycles of R-DHAP (Cycles 2, 4, 6) as induction therapy followed by high-dose chemotherapy and ASCT (Control Arm).

The efficacy analyses were conducted based on 809 patients in the full analysis set (FAS) population using 3 pairwise comparisons of the 3 treatment arms: IMBRUVICA + ASCT vs. ASCT; IMBRUVICA vs. ASCT; and IMBRUVICA + ASCT vs. IMBRUVICA. The FAS population included patients that have either provided explicit permission for their data to be included as per EU General Data Protection Regulation or were deceased. The results presented are from the IMBRUVICA (N=265) arm and the ASCT (N=268) arm, only.

Induction with R-CHOP (rituximab 375 mg/m^2 on Day 0 or 1, cyclophosphamide 750 mg/m^2 on Day 1, doxorubicin 50 mg/m^2 on Day 1, vincristine 1.4 mg/m^2 up to maximum of 2 mg on Day 1, and prednisone 100 mg on days 1-5) alternating with R-DHAP (rituximab 375 mg/m^2 on Day 0 or 1, dexamethasone 40 mg on days 1-4, Ara-C 2x 2 g/m^2 every 12 hours on Day 2, cisplatin 100 mg/m^2 (alternatively oxaliplatin 130 mg/m^2) on Day 1, and G-CSF 5 µg/kg from Day 6 until recovery of WBC) was the same in all 3 treatment arms. Rituximab maintenance therapy was allowed in all treatment groups (59.7% in the IMBRUVICA arm; 62.5% in the ASCT arm) according to national treatment guidelines.

The median age was 57 years (range: 27 to 65 years), 78% were male and 99% were Caucasian. Ninety-eight percent of patients had a baseline ECOG performance status of 0 or 1. At baseline, 86% had Ann Arbor Stage IV disease, and 57%, 28%, and 15% of patients had low, intermediate, and high-risk score by MCL International Prognostic Index (MIPI), respectively. Of the patients 11.6% had blastoid or pleomorphic histology. P53 expression was assessed in 64.6% of patients; expression >50% was present in 14.1% of these patients. Ki-67 proliferation index was assessed in 88.3% of patients and 32.9% of these patients had a proliferation index of >30%.

Tumour response was assessed according to the revised International Working Group (IWG) for non-Hodgkin's lymphoma (NHL) criteria (2007). The primary endpoint was failure-free survival (FFS), defined as the time from randomisation to stable disease at end of induction chemoimmunotherapy, progressive disease, or death from any cause, whichever was earlier.

With a median follow-up time on study of 54.9 months, efficacy results for TRIANGLE are shown in Table 28. The Kaplan-Meier curves for FFS and OS are shown in Figures 1 and 2, respectively.

Table 28: Efficacy results in patients with previously untreated MCL (TRIANGLE) (FAS population)

Endpoint	IMBRUVICA Arm N=268	ASCT Arm N=269
Failure-free survival[±]		
Number of events (%)	61 (22.8%)	87 (32.3%)
Stable Disease at the end of induction	1 (0.4%)	5 (1.9%)
Disease progression	49 (18.3%)	60 (22.3%)
Death events	11 (4.1%)	22 (8.2%)
Median (95% CI), months	NE (NE, NE)	NE (NE, NE)
IMBRUVICA vs ASCT Arms HR (98.33% CI) (P-value)[*]	0.639 (0.428, 0.953) (0.0068)	
Overall Survival[§]		
Number of deaths (%)	33 (12.3%)	60 (22.3%)
IMBRUVICA vs ASCT Arms HR (95% CI) (P-value)[*]	0.522 (0.341, 0.799) (0.0023)	
Overall Response Rate (%)[§] (95% CI)	258 (96.3%) (93.3%, 98.2%)	248 (92.2%) (88.3%, 95.1%)
CR rate (%)[§] (95% CI)	180 (67.2%) (61.2%, 72.8%)	174 (64.7%) (58.7%, 70.4%)

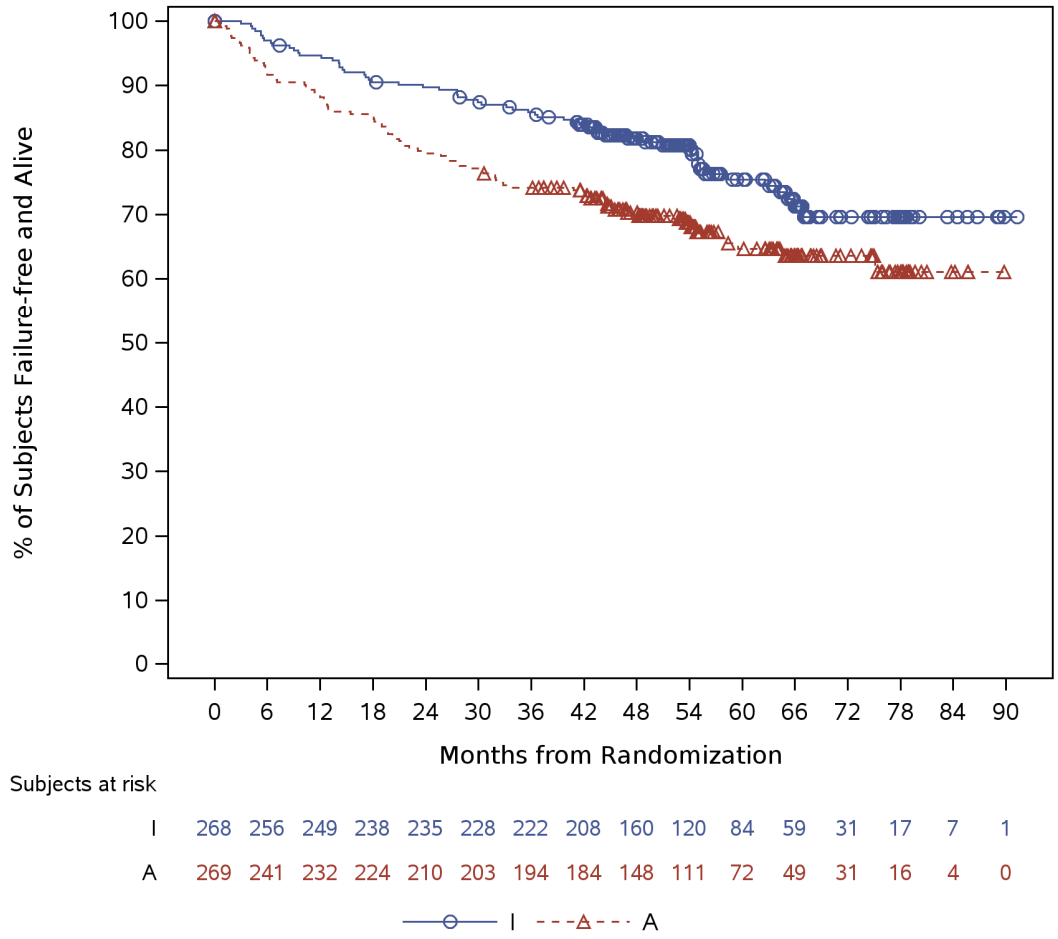
FFS=failure-free survival; NE=not estimable; HR=hazard ratio (based on unstratified Cox-regression model); RR=relative risk; CI=confidence interval; CR=complete response; FAS=full analysis set

[±] The FFS results are not controlled for type 1 error, as these analyses are derived from supplemental analyses conducted for registrational purposes

[*]Two-sided p-values are from unstratified log-rank test; p-values were tested based on $p<0.0167$

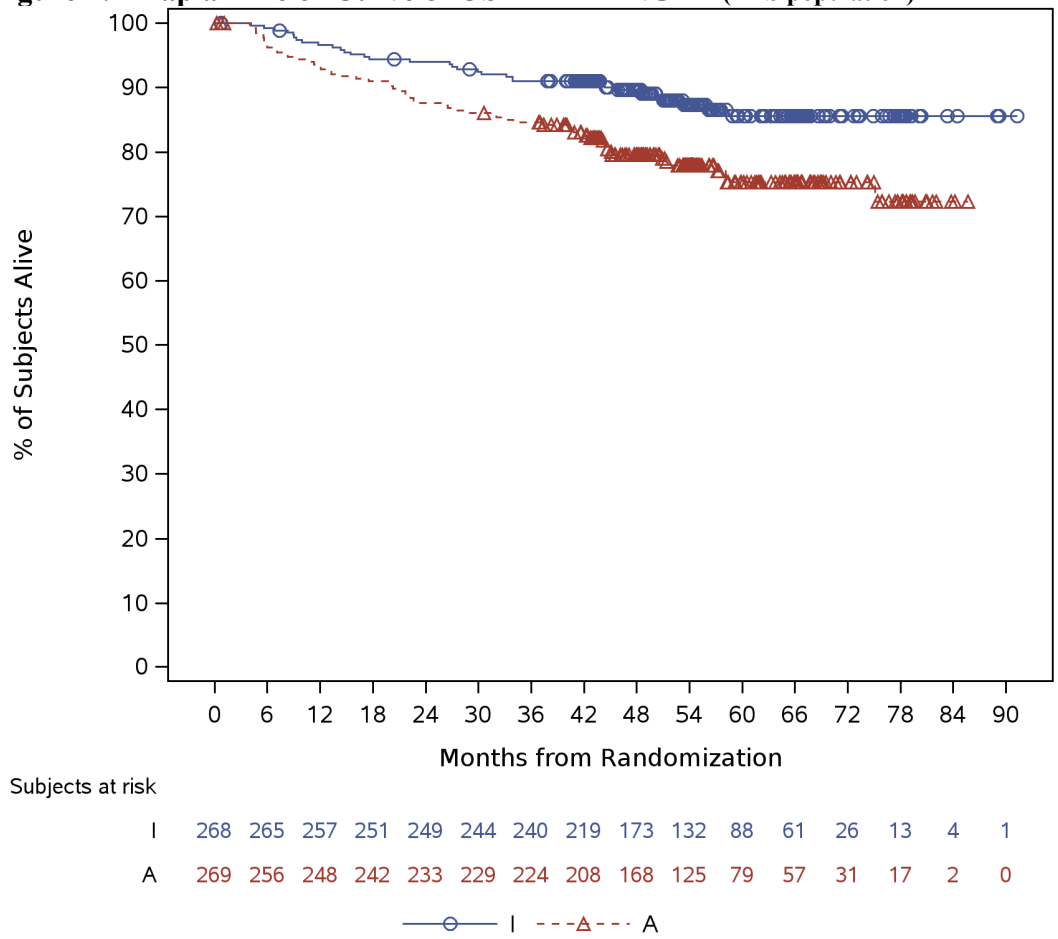
[§]Presented results are derived from descriptive analysis

Figure 1: Kaplan-Meier Curve of European MCL Network Assessed Failure-free Survival in TRIANGLE (FAS population)*



* I=IMBRUVICA; A=ASCT

Figure 2: Kaplan-Meier Curve of OS[§] in TRIANGLE (FAS population)*



*I=IMBRUVICA; A=ASCT

§Presented results are derived from descriptive analysis

Patients with MCL who received at least one prior therapy

The safety and efficacy of IMBRUVICA in patients with MCL who have received at least one prior therapy were evaluated in Study 1104 (NCT01236391), an open-label, multi-center, single-arm trial of 111 previously treated patients. IMBRUVICA was administered orally at 560 mg once daily until disease progression or unacceptable toxicity. Tumor response was assessed according to the revised International Working Group (IWG) for non-Hodgkin's lymphoma (NHL) criteria. The primary endpoint in this study was investigator-assessed overall response rate (ORR).

The median age was 68 years (range, 40 to 84 years), 77% were male, and 92% were White. At baseline, 89% of patients had a baseline ECOG performance status of 0 or 1. The median time since diagnosis was 42 months, and median number of prior treatments was 3 (range, 1 to 5 treatments), including 11% with prior stem cell transplantation. At baseline, 39% of subjects had at least one tumor ≥ 5 cm, 49% had bone marrow involvement, and 54% had extranodal involvement at screening.

Responses to IMBRUVICA are shown in Table 29.

Table 29: Overall Response Rate (ORR) and Duration of Response (DOR) Based on Investigator Assessment in Patients with MCL in Study 1104

	Total (N=111)
ORR (%)	65.8
95% CI (%)	(56.2, 74.5)
CR (%)	17.1
PR (%)	48.6
Median DOR months (95% CI)	17.5 (15.8, NE)

CI = confidence interval; CR = complete response; PR = partial response; NE = not evaluable

An Independent Review Committee (IRC) performed independent reading and interpretation of imaging scans. The IRC review demonstrated an ORR of 69%.

The median time to response was 1.9 months.

Lymphocytosis

Upon initiation of IMBRUVICA, a temporary increase in lymphocyte counts (i.e., ≥ 50% increase from baseline and above absolute lymphocyte count of 5,000/mcL) occurred in 33% of patients in the MCL study. The onset of isolated lymphocytosis occurs during the first few weeks of IMBRUVICA therapy and resolves by a median of 8 weeks.

16.2 Chronic Lymphocytic Leukemia / Small Lymphocytic Lymphoma

The safety and efficacy of IMBRUVICA in patients with CLL/SLL were demonstrated in one uncontrolled trial and five randomized, controlled trials.

Study 1102

Study 1102 (NCT01105247), an open-label, multi-center trial, was conducted in 48 previously treated CLL patients. IMBRUVICA was administered orally at 420 mg once daily until disease progression or unacceptable toxicity. The ORR and DOR were assessed using a modified version of the International Workshop on CLL Criteria by an Independent Review Committee.

The median age was 67 years (range, 37 to 82 years), 71% were male, and 94% were White. All patients had a baseline ECOG performance status of 0 or 1. The median time since diagnosis was 80 months and the median number of prior treatments was 4 (range, 1 to 12 treatments). At baseline, 46% of subjects had at least one tumor ≥ 5 cm.

The ORR was 58.3% (95% CI: 43.2%, 72.4%), all partial responses. None of the patients achieved a complete response. The DOR ranged from 5.6 to 24.2+ months. The median DOR was not reached.

RESONATE

The RESONATE study, a randomized, multicenter, open-label, phase 3 study of IMBRUVICA versus ofatumumab (NCT01578707), was conducted in patients with previously treated CLL or SLL. Patients (n=391) were randomized 1:1 to receive either IMBRUVICA 420 mg daily until disease progression, or unacceptable toxicity or ofatumumab at an initial dose of 300 mg, followed one week later by a dose of 2000 mg weekly for 7 doses and then every 4 weeks for 4 additional doses. Fifty-seven patients randomized to ofatumumab crossed over following progression to receive IMBRUVICA.

The median age was 67 years (range, 30 to 88 years), 68% were male, and 90% were White. All patients had a baseline ECOG performance status of 0 or 1. The trial enrolled 373 patients with CLL and 18 patients with SLL. The median time since diagnosis was 91 months and the median number of prior treatments was 2 (range, 1 to 13 treatments). At baseline, 58% of patients had at least one tumor ≥ 5 cm. Thirty-two percent of patients had 17p deletion.

Efficacy results for RESONATE are shown in Table 30 and the Kaplan-Meier curves for PFS, assessed by an IRC according to IWCLL criteria, and OS are shown in Figure 3 and Figure 4, respectively.

Table 30: Efficacy Results in Patients with CLL/SLL in RESONATE

Endpoint	IMBRUVICA N=195	Ofatumumab N=196
Progression Free Survival[b]		
Number of events (%)	35 (17.9)	111 (56.6)
Disease progression	26	93
Death events	9	18
Median (95% CI), months	NE	8.1 (7.2, 8.3)
HR (95% CI)	0.22 (0.15, 0.32)	
Overall Survival[a]		
Number of deaths (%)	16 (8.2)	33 (16.8)
HR (95% CI)	0.43 (0.24, 0.79)	
Overall Response Rate[b]	42.6%	4.1%

[a] Median OS not evaluable for either arm

[b] IRC evaluated. All partial responses achieved; none of the patients achieved a complete response.

CI = confidence interval; HR = hazard ratio; NE = not evaluable

Figure 3: Kaplan-Meier Curve of Progression Free Survival (ITT Population) in Patients with CLL/SLL in RESONATE

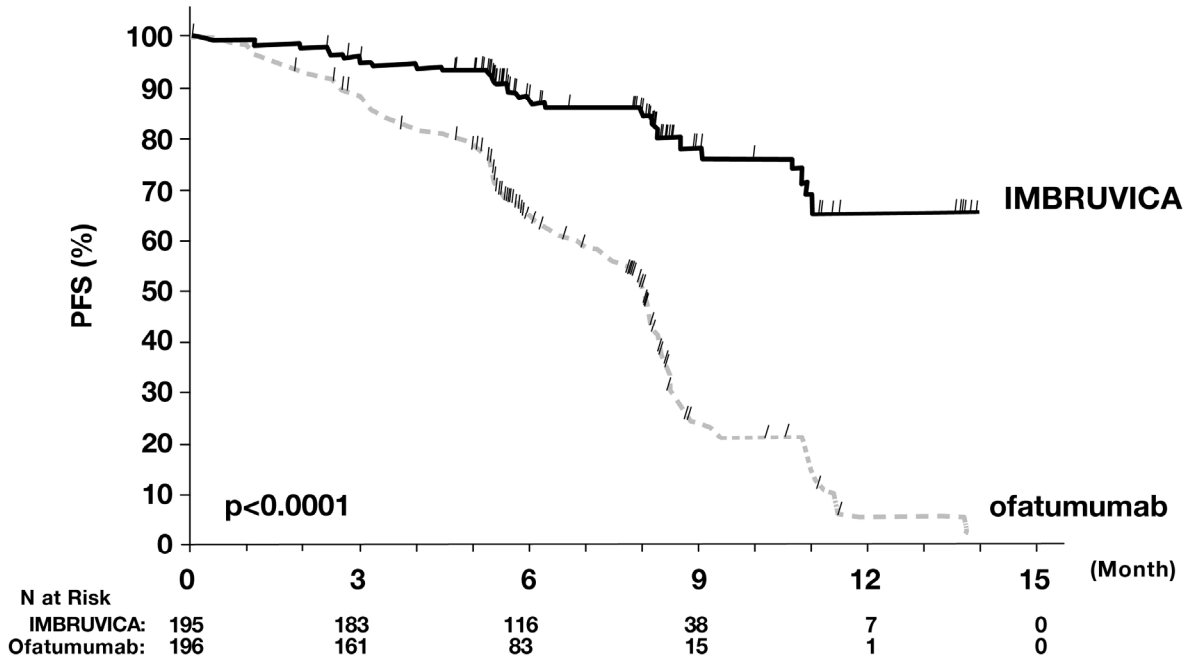
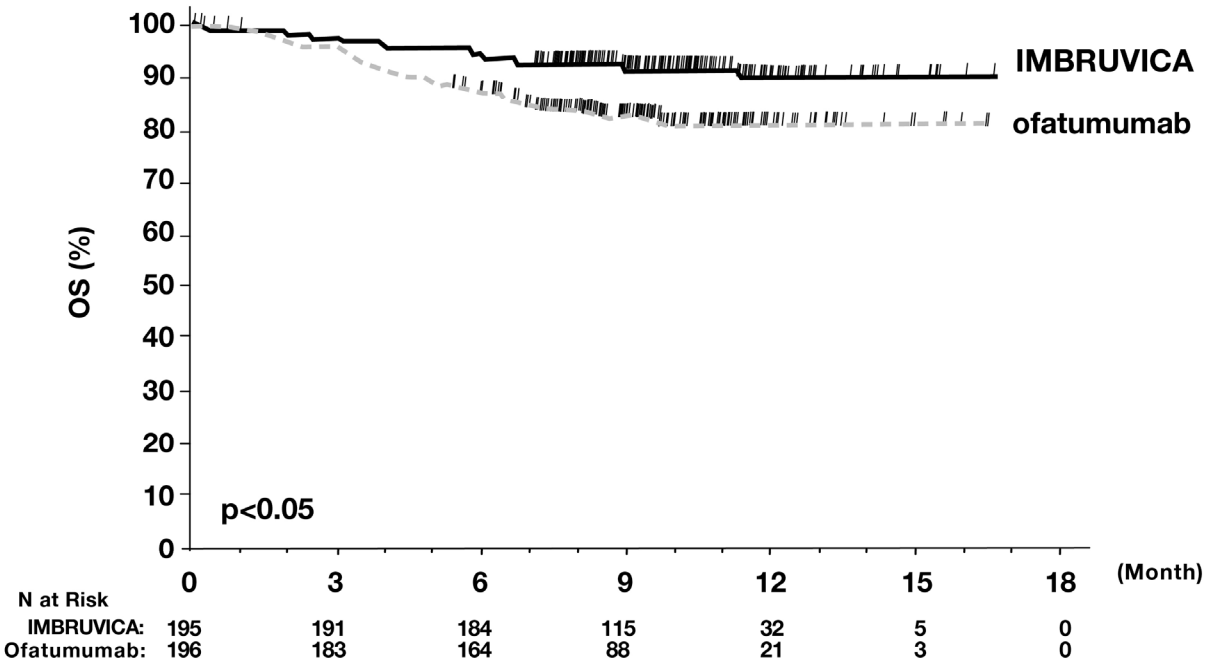


Figure 4: Kaplan-Meier Curve of Overall Survival (ITT Population) in Patients with CLL/SLL in RESONATE



63-Month Follow-Up

With an overall follow-up of 63 months, the median investigator-assessed PFS per IWCLL criteria was 44.1 months [95% CI (38.5, 56.9)] in the IMBRUVICA arm and 8.1 months [95% CI (7.8, 8.3)] in the ofatumumab arm. Overall response rate as assessed by investigators was 87.2% in the IMBRUVICA arm versus 22.4% in the ofatumumab arm.

CLL/SLL with 17p deletion (del 17p CLL/SLL) in RESONATE

RESONATE included 127 patients with del 17p CLL/SLL. The median age was 67 years (range, 30 to 84 years), 62% were male, and 88% were White. All patients had a baseline ECOG performance status of 0 or 1. PFS and ORR were assessed by an IRC. Efficacy results for del 17p CLL/SLL are shown in Table 31.

Table 31: Efficacy Results in Patients with del 17p CLL/SLL in RESONATE

Endpoint	IMBRUVICA N=63	Ofatumumab N=64
Progression Free Survival[a]		
Number of events (%)	16 (25.4)	38 (59.4)
Disease progression	12	31
Death events	4	7
Median (95% CI), months	NE	5.8 (5.3, 7.9)
HR (95% CI)	0.25 (0.14, 0.45)	
Overall Response Rate[a]	47.6%	4.7%

[a] IRC evaluated. All partial responses achieved; none of the patients achieved a complete response.
CI = confidence interval; HR = hazard ratio; NE = not evaluable

63-Month Follow-Up

With an overall follow-up of 63 months, the median investigator-assessed PFS in patients with del 17p per IWCLL criteria was 40.6 months [95% CI (25.4, 44.6)] in the IMBRUVICA arm and 6.2 months [95% CI (4.6, 8.1)] in the ofatumumab arm. Overall response rate as assessed by investigators in patients with del 17p was 88.9% in the IMBRUVICA arm versus 18.8% in the ofatumumab arm.

RESONATE-2

The RESONATE-2 study, a randomized, multicenter, open-label, phase 3 study of IMBRUVICA versus chlorambucil (NCT01722487), was conducted in patients with treatment naïve CLL or SLL who were 65 years of age or older. Patients (n = 269) were randomized 1:1 to receive either IMBRUVICA 420 mg daily until disease progression or unacceptable toxicity, or chlorambucil at a starting dose of 0.5 mg/kg on Days 1 and 15 of each 28-day cycle for a maximum of 12 cycles, with an allowance for intrapatient dose increases up to 0.8 mg/kg based on tolerability.

The median age was 73 years (range, 65 to 90 years), 63% were male, and 91% were White. Ninety one percent of patients had a baseline ECOG performance status of 0 or 1 and 9% had an ECOG performance status of 2. The trial enrolled 249 patients with CLL and 20 patients with SLL. At baseline, 20% of patients had 11q deletion. The most common reasons for initiating CLL therapy include: progressive marrow failure

demonstrated by anemia and/or thrombocytopenia (38%), progressive or symptomatic lymphadenopathy (37%), progressive or symptomatic splenomegaly (30%), fatigue (27%) and night sweats (25%).

With a median follow-up of 28.1 months, there were 32 observed death events [11 (8.1%) and 21 (15.8%) in IMBRUVICA and chlorambucil treatment arms, respectively]. With 41% of patients switching from chlorambucil to IMBRUVICA, the overall survival analysis in the ITT patient population resulted in a statistically significant HR of 0.44 [95% CI (0.21, 0.92)] and 2-year survival rate estimates of 94.7% [95% CI (89.1, 97.4)] and 84.3% [95% CI (76.7, 89.6)] in the IMBRUVICA and chlorambucil arms, respectively.

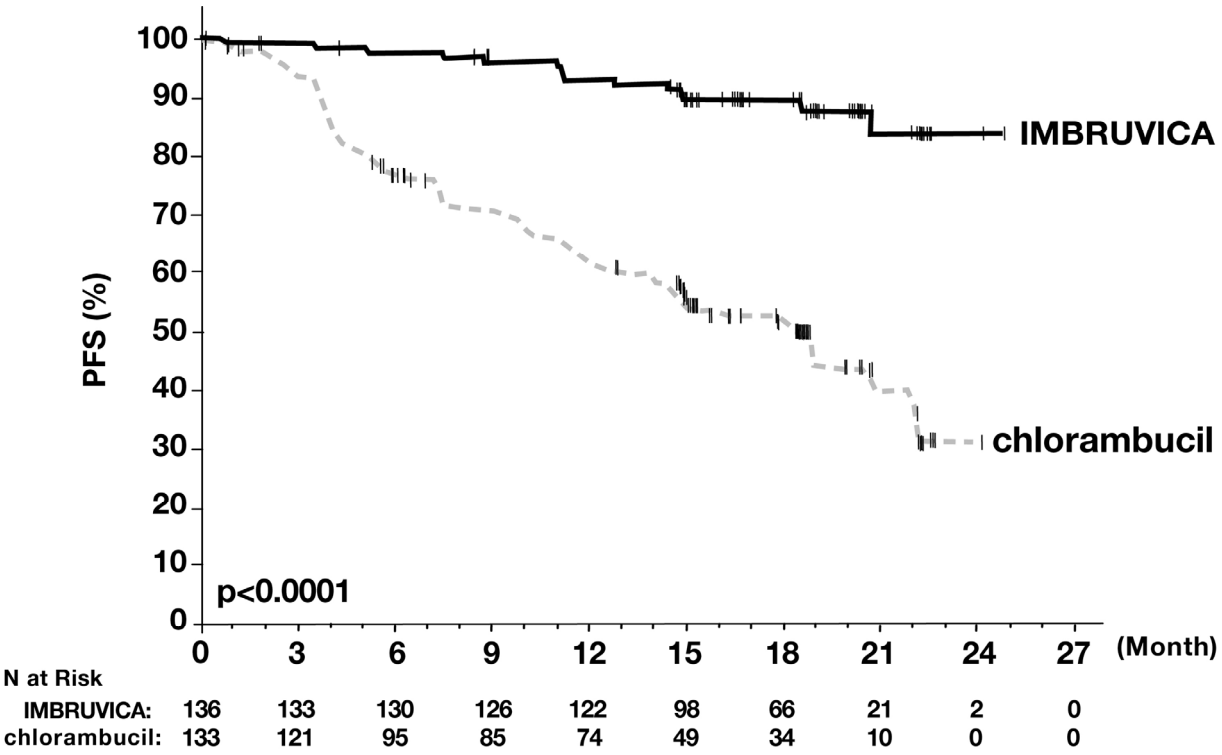
Efficacy results for RESONATE-2 are shown in Table 32 and the Kaplan-Meier curve for PFS, assessed by an IRC according to IWCLL criteria is shown in Figure 5.

Table 32: Efficacy Results in Patients with CLL/SLL in RESONATE-2

Endpoint	IMBRUVICA N=136	Chlorambucil N=133
Progression Free Survival[a]		
Number of events (%)	15 (11.0)	64 (48.1)
Disease progression	12	57
Death events	3	7
Median (95% CI), months	NE	18.9 (14.1, 22.0)
HR[b] (95% CI)	0.16 (0.09, 0.28)	
Overall Response Rate[a] (CR + PR)	82.4%	35.3%
P-value	<0.0001	

[a] IRC evaluated; Five subjects (3.7%) in the IMBRUVICA arm and two subjects (1.5%) in the Chlorambucil arm achieved complete response
[b] HR = hazard ratio; NE = not evaluable

Figure 5: Kaplan-Meier Curve of Progression-Free Survival (ITT Population) in Patients with CLL/SLL in RESONATE-2



55-Month Follow-Up

With an overall follow-up of 55 months, the median PFS was not reached in the IMBRUVICA arm.

HELIOS

The HELIOS study, a randomized, double-blind, placebo-controlled phase 3 study of IMBRUVICA in combination with bendamustine and rituximab (BR) (NCT01611090), was conducted in patients with previously treated CLL or SLL. Patients (n = 578) were randomized 1:1 to receive either IMBRUVICA 420 mg daily or placebo in combination with BR until disease progression, or unacceptable toxicity. All patients received BR for a maximum of six 28-day cycles. Bendamustine was dosed at 70 mg/m^2 infused IV over 30 minutes on Cycle 1, Days 2 and 3, and on Cycles 2-6, Days 1 and 2 for up to 6 cycles, and all patients had a CLCr ≥ 40 mL/min at baseline. Rituximab was administered at a dose of 375 mg/m^2 in the first cycle, Day 1, and 500 mg/m^2 Cycles 2 through 6, Day 1.

The median age was 64 years (range, 31 to 86 years), 66% were male, and 91% were White. All patients had a baseline ECOG performance status of 0 or 1. The median time since diagnosis was 5.9 years and the median number of prior treatments was 2 (range, 1 to 11 treatments). At baseline, 56% of patients had at least one tumor ≥ 5 cm and 26% presented with del11q.

Efficacy results for HELIOS are shown in Table 33 and the Kaplan-Meier curves for PFS are shown in Figure 6.

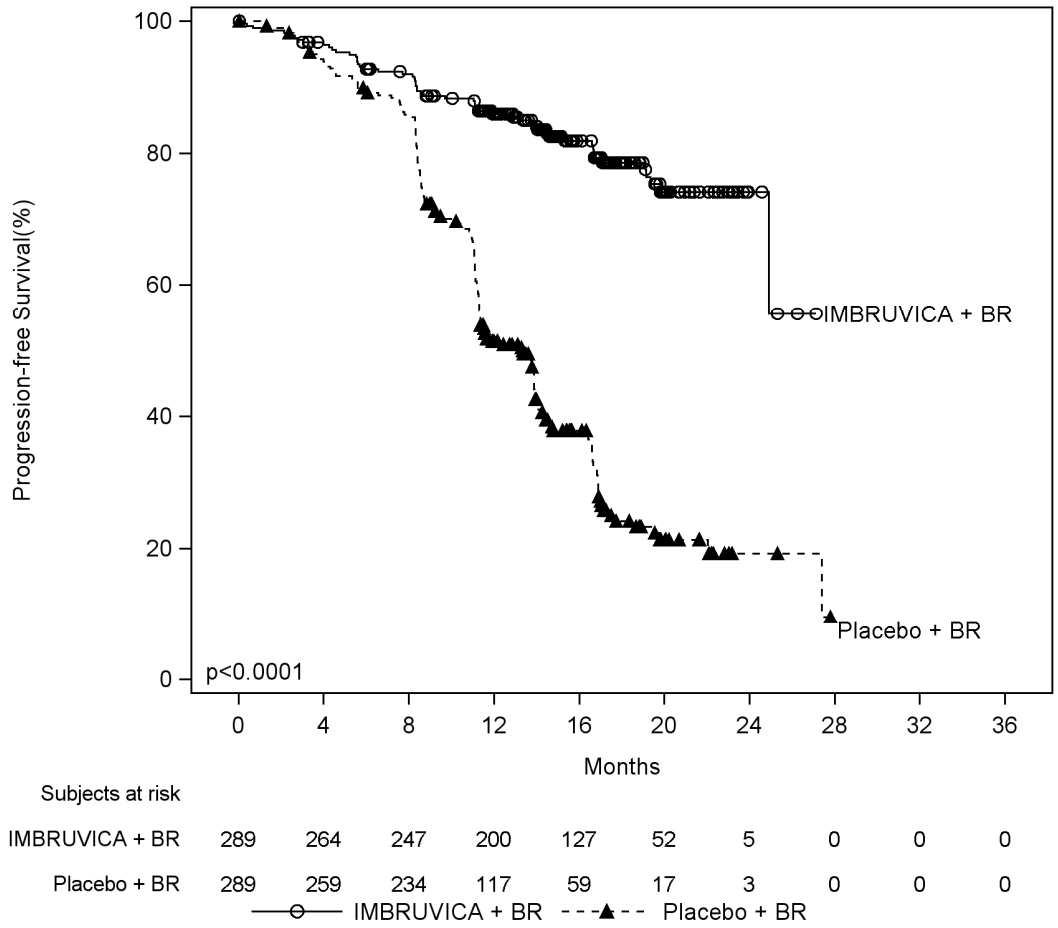
Table 33: Efficacy Results in Patients with CLL/SLL in HELIOS

Endpoint	IMBRUVICA + BR N=289	Placebo + BR N=289
Progression Free Survival[a]		
Number of events (%)	56 (19.4)	183 (63.3)
Median (95% CI), months	NE	13.3 (11.3, 13.9)
HR (95% CI)	0.20 (0.15, 0.28)	
Overall Response Rate[a]	82.7%	67.8%

[a] IRC evaluated, twenty-four subjects (8.3%) in the IMBRUVICA + BR arm and six subjects (2.1%) in the placebo + BR arm achieved complete response

BR = bendamustine and rituximab; CI = confidence interval; HR = hazard ratio; NE = not evaluable

Figure 6: Kaplan-Meier Curve of Progression-Free Survival (ITT Population) in Patients with CLL/SLL in HELIOS



iLLUMINATE

The iLLUMINATE study, a randomized, multi-center, phase 3 study of IMBRUVICA in combination with obinutuzumab versus chlorambucil in combination with obinutuzumab (NCT02264574), was conducted in patients with treatment naïve CLL or SLL. Patients were 65 years of age or older or < 65 years of age with coexisting medical conditions, reduced renal function as measured by creatinine clearance < 70 mL/min, or

presence of del 17p/TP53 mutation. Patients (n = 229) were randomized 1:1 to receive either IMBRUVICA 420 mg daily until disease progression or unacceptable toxicity or chlorambucil at a dose of 0.5 mg/kg on Days 1 and 15 of each 28-day cycle for 6 cycles. In both arms, patients received 1,000 mg of obinutuzumab on Days 1, 8, and 15 of the first cycle, followed by treatment on the first day of 5 subsequent cycles (total of 6 cycles, 28 days each). The first dose of obinutuzumab was divided between Day 1 (100 mg) and Day 2 (900 mg).

The median age was 71 years (range, 40 to 87 years), 64% were male, and 96% were White. All patients had a baseline ECOG performance status of 0 (48%) or 1-2 (52%). The trial enrolled 214 patients with CLL and 15 patients with SLL. At baseline, 65% of patients presented with CLL/SLL with high risk factors (del 17p/TP53 mutation [18%], del 11q [15%], or unmutated immunoglobulin heavy-chain variable region (unmutated IGHV) [54%]). The most common reasons for initiating CLL therapy included: lymphadenopathy (38%), night sweats (34%), progressive marrow failure (31%), fatigue (29%), splenomegaly (25%), and progressive lymphocytosis (21%).

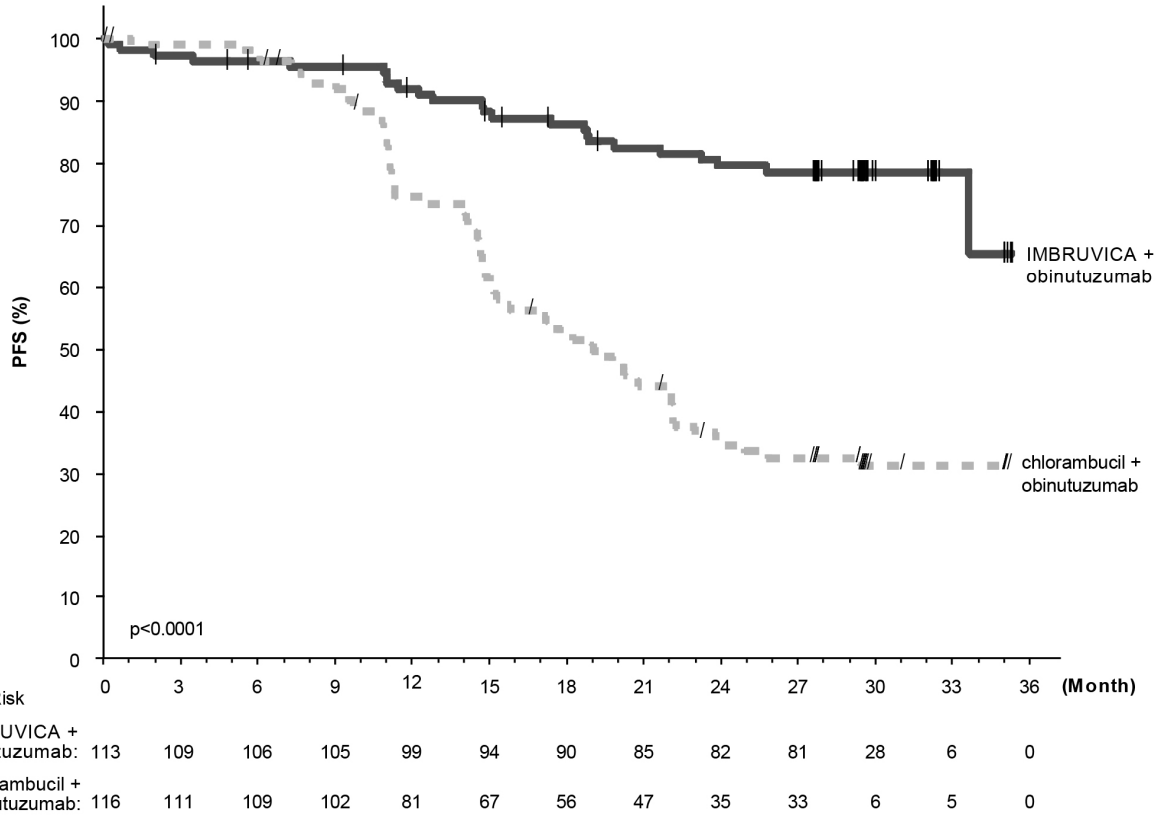
With a median follow-up time on study of 31 months, efficacy results for iLLUMINATE assessed by an IRC according to IWCLL criteria are shown in Table 34, and the Kaplan-Meier curve for PFS is shown in Figure 7.

Table 34: Efficacy Results in Patients with CLL/SLL in iLLUMINATE

Endpoint	IMBRUVICA + Obinutuzumab N=113	Chlorambucil + Obinutuzumab N=116
Progression Free Survival[a]		
Number of events (%)	24 (21)	74 (64)
Disease progression	11	64
Death events	13	10
Median (95% CI), months	NE	19.0 (15.1, 22.1)
HR (95% CI)	0.23 (0.15, 0.37)	
P-value[b]	<0.0001	
Overall Response Rate (%)[a]	88.5	73.3
CR[c] (%)	19.5	7.8
PR[d] (%)	69.0	65.5

[a] IRC-evaluated
[b] P-value is from unstratified log-rank test
[c] Includes 1 patient in the IMBRUVICA + obinutuzumab arm with a complete response with incomplete marrow recovery (CRi)
[d] PR = nPR +PR
HR = hazard ratio; NE = not evaluable

Figure 7: Kaplan-Meier Curve of Progression-Free Survival (ITT Population) in Patients with CLL/SLL in iLLUMINATE



In the high risk CLL/SLL population (del 17p/TP53 mutation, del 11q, or unmutated IGHV), the PFS HR was 0.15 [95% CI (0.09, 0.27)].

E1912

The E1912 study, a randomized, multi-center, phase 3 study of IMBRUVICA in combination with rituximab versus standard fludarabine, cyclophosphamide, and rituximab (FCR) chemoimmunotherapy (NCT02048813), was conducted in adult patients who were 70 years or younger with previously untreated CLL or SLL requiring systemic therapy. All patients had a CLcr > 40 mL/min at baseline. Patients with 17p deletion were excluded. Patients (n =529) were randomized 2:1 to receive either IMBRUVICA plus rituximab or FCR. IMBRUVICA was administered at 420 mg daily until disease progression or unacceptable toxicity. Fludarabine was administered at a dose of 25 mg/m^2, and cyclophosphamide was administered at a dose of 250 mg/m^2, both on Days 1, 2, and 3 of Cycles 1-6. Rituximab was initiated in Cycle 2 for the IMBRUVICA plus rituximab arm and in Cycle 1 for the FCR arm and was administered at 50 mg/m^2 on Day 1 of the first cycle, 325 mg/m^2 on Day 2 of the first cycle, and 500 mg/m^2 on Day 1 of 5 subsequent cycles, for a total of 6 cycles. Each cycle was 28 days.

The median age was 58 years (range, 28 to 70 years), 67% were male, 90% were White and 98% had a ECOG performance status of 0-1. At baseline, 43% of patients were Rai stage 3 or 4 and 59% of patients presented with high risk factors (TP53 mutation [6%], del11q [22%], or unmutated IGHV [53%]).

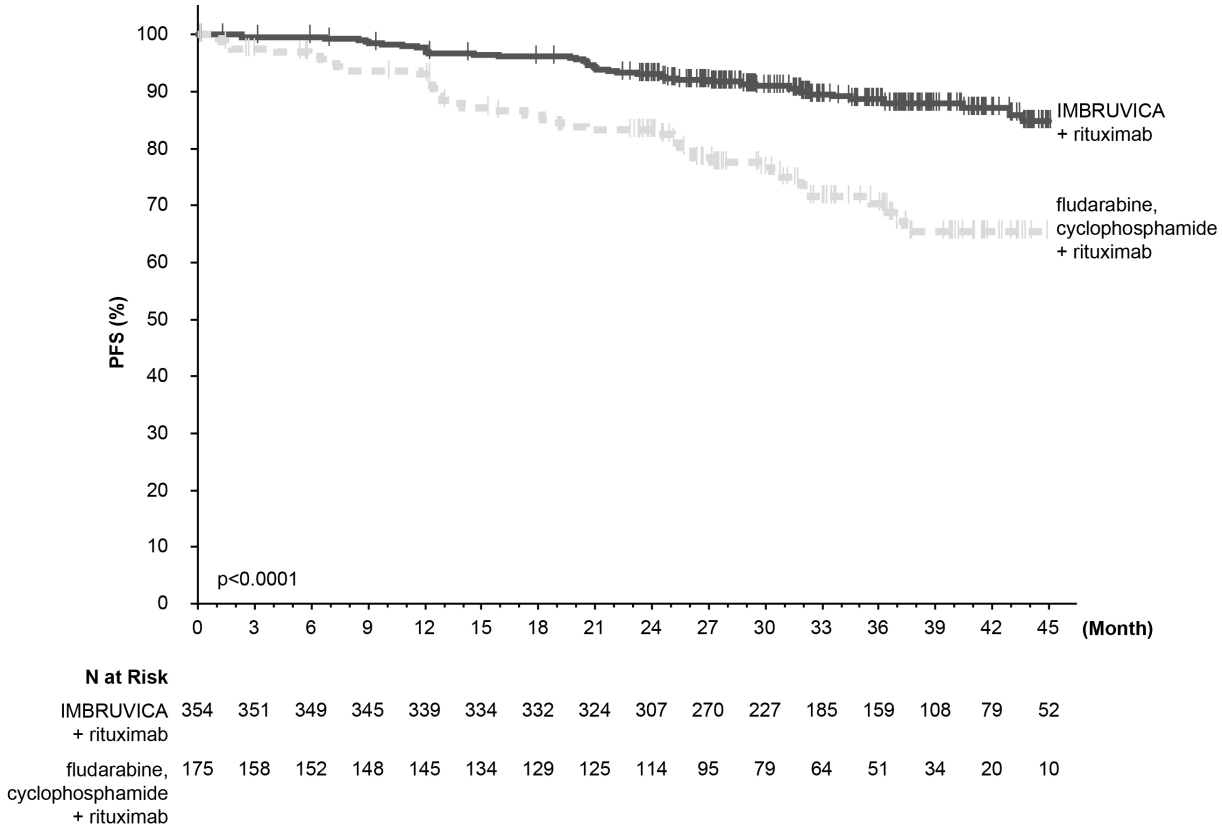
With a median follow-up time on study of 37 months, efficacy results for E1912 are shown in Table 35. The Kaplan-Meier curves for PFS, assessed according to IWCLL criteria is shown in Figure 8.

Table 35: Efficacy Results in Patients with CLL/SLL in E1912

Endpoint	IMBRUVICA + R N=354	FCR N=175
Progression Free Survival		
Number of events (%)	41 (12)	44 (25)
Disease progression	39	38
Death events	2	6
Median (95% CI), months	NE (49.4, NE)	NE (47.1, NE)
HR (95% CI)	0.34 (0.22, 0.52)	
P-value[a]	<0.0001	

[a] P-value is from unstratified log-rank test.
FCR = fludarabine, cyclophosphamide, and rituximab; HR = hazard ratio; R = rituximab; NE = not evaluable

Figure 8: Kaplan-Meier Curve of Progression-Free Survival (ITT Population) in Patients with CLL/SLL in E1912



With a median follow-up time on study of 49 months, median overall survival was not reached with a total of 23 deaths: 11 (3%) in the IMBRUVICA plus rituximab and 12 (7%) in the FCR treatment arms.

Lymphocytosis

Upon initiation of single-agent IMBRUVICA, an increase in lymphocyte counts (i.e., ≥ 50% increase from baseline and above absolute lymphocyte count of 5,000/mcL) occurred in 66% of patients in the CLL studies. The onset of isolated lymphocytosis occurs during the first month of IMBRUVICA therapy and resolves by a median of 14 weeks (range, 0.1 to 104 weeks). When IMBRUVICA was administered in combination, lymphocytosis was 7% with IMBRUVICA + BR versus 6% with placebo + BR and 7% with IMBRUVICA + obinutuzumab versus 1% with chlorambucil + obinutuzumab.

Fixed duration combination therapy

The safety and efficacy of fixed duration therapy with IMBRUVICA in combination with venetoclax versus chlorambucil in combination with obinutuzumab in patients with previously untreated CLL were evaluated in a randomised, open-label, phase 3 (CLL3011) study. The study enrolled patients with previously untreated CLL who were 65 years or older, and adult patients <65 years of age with a CIRS score >6 or CrCL ≥30 to <70 mL/min. Patients with del 17p or known TP53 mutations were excluded. Patients (n=211) were randomised 1:1 to receive either IMBRUVICA in combination with venetoclax or chlorambucil in combination with obinutuzumab. Patients in the IMBRUVICA plus venetoclax arm received single agent IMBRUVICA for 3 cycles followed by IMBRUVICA in combination with venetoclax for 12 cycles (including 5-week dose-titration schedule). Each cycle was 28 days. IMBRUVICA was administered at a dose of 420 mg daily. Venetoclax was administered daily, starting with 20 mg for 1 week, followed by 1 week at each dose level of 50 mg, 100 mg, and 200 mg, then the recommended daily dose of 400 mg. Patients randomised to the chlorambucil plus obinutuzumab arm received treatment for 6 cycles. Obinutuzumab was administered at a dose of 1,000 mg on Days 1, 8 and 15 in Cycle 1. In Cycles 2 to 6, 1,000 mg obinutuzumab was given on Day 1. Chlorambucil was administered at a dose of 0.5 mg/kg body weight on Days 1 and 15 of Cycles 1 to 6. Patients with confirmed progression by IWCLL criteria after completion of either fixed duration regimen could be treated with single-agent IMBRUVICA.

The median age was 71 years (range, 47 to 93 years), 58% were male, and 96% were Caucasian. All patients had a baseline ECOG performance status of 0 (35%), 1 (53%), or 2 (12%). At baseline, 18% of patients presented with CLL with del 11q and 52% with unmutated IGHV.

At baseline assessment for risk of tumor lysis syndrome, 25% of patients had high tumor burden. After 3 cycles of single-agent IMBRUVICA lead-in therapy, 2% of patients had high tumor burden. High tumor burden was defined as any lymph node ≥10 cm; or any lymph node ≥5 cm and absolute lymphocyte count $\geq 25 \times 10^9$/L.

With a median follow-up time on study of 28 months, efficacy results for Study CLL3011 assessed by an IRC according to IWCLL criteria are shown in Table 28, the Kaplan-Meier curve for PFS is shown in Figure 7, and rates of minimal residual disease (MRD) negativity are shown in Table 36.

Table 36: Efficacy Results in Study CLL3011

Endpoint[a]	**IMBRUVICA + Venetoclax N=106**	**Chlorambucil + Obinutuzumab N=105**
Progression Free Survival		
Number of events (%)	22 (20.8)	67 (63.8)
Median (95% CI), months	NE (31.2, NE)	21.0 (16.6, 24.7)
HR (95% CI)	0.22 (0.13, 0.36)	
P-value[b]	<0.0001	
Complete Response Rate (%)[c]	38.7	11.4
95% CI	(29.4, 48.0)	(5.3, 17.5)
P-value[d]	<0.0001	
Overall Response Rate (%)[e]	86.8	84.8
95% CI	(80.3, 93.2)	(77.9, 91.6)

[a] Based on IRC assessment

[b] P-value is from stratified log-rank test

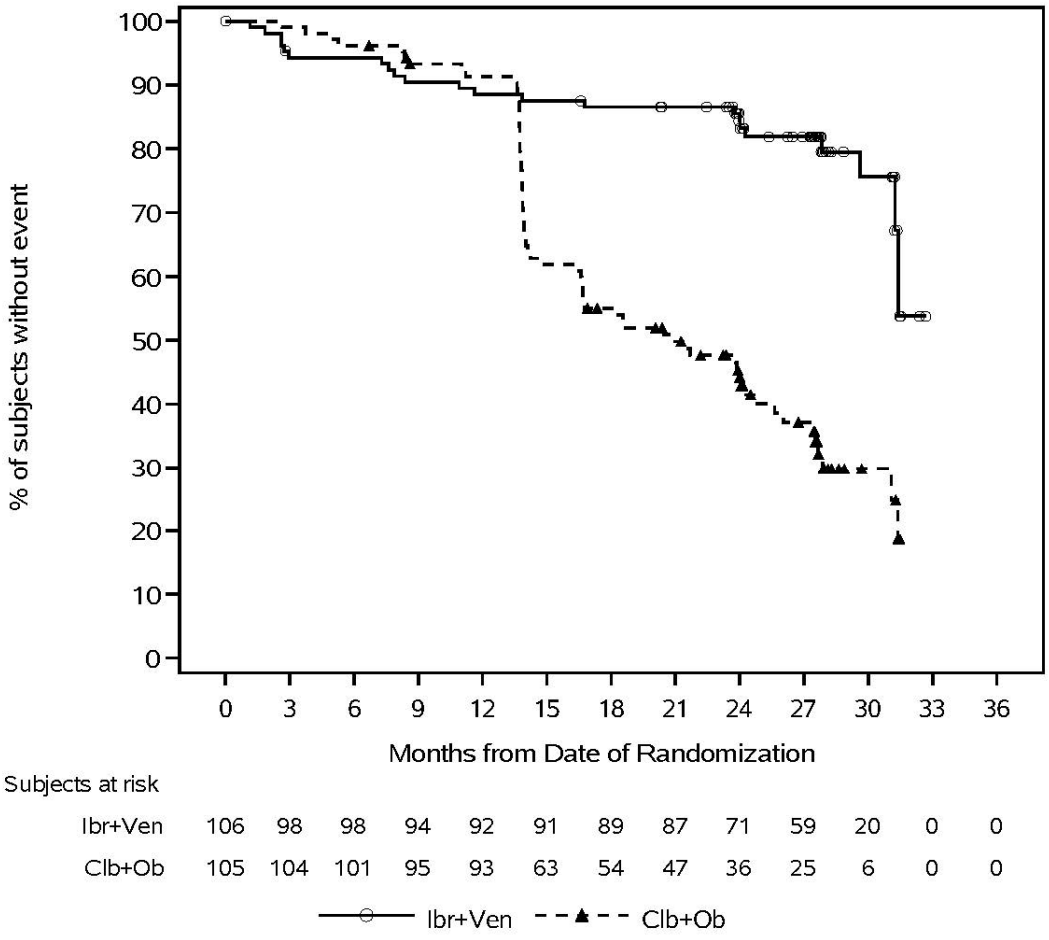
[c] Includes 3 patients in the IMBRUVICA + venetoclax arm with a complete response with incomplete marrow recovery (CRi)

[d] P-value is from Cochran-Mantel-Haenszel chi-square test

[e] Overall response = CR+CRi+nPR+PR

CR = complete response; CRi = complete response with incomplete marrow recovery; HR = hazard ratio; NE = not evaluable; nPR = nodular partial response; PR = partial response

Figure 9: Kaplan-Meier Curve of Progression-Free Survival (ITT Population) in Patients with CLL in Study CLL3011



The treatment effect of IMBRUVICA plus venetoclax was consistent across the high-risk CLL population (TP53 mutation, del 11q, or unmutated IGHV), with a PFS HR of 0.23 [95% CI (0.13, 0.41)].

Overall survival data were not mature. With a median follow-up of 28 months, there was no significant difference between treatment arms with a total of 23 deaths: 11 (10.4%) in the IMBRUVICA plus venetoclax arm and 12 (11.4%) in the chlorambucil plus obinutuzumab arm with a OS HR of 1.048 [95% CI (0.454, 2.419)]. After 6 months additional follow-up, 11 (10.4%) and 16 (15.2%) deaths were reported in the IMBRUVICA plus venetoclax arm and the chlorambucil plus obinutuzumab arm, respectively with OS HR estimated at 0.760 [95% CI (0.352, 1.642]).

Table 38: Minimal Residual Disease Negativity Rates in Study CLL3011

	NGS Assay[a]		**Flow cytometry[b]**	
	IMBRUVICA + Venetoclax N=106	**Chlorambucil + Obinutuzumab N=105**	**IMBRUVICA + Venetoclax N=106**	**Chlorambucil + Obinutuzumab N=105**
MRD Negativity Rate				
Bone marrow, n (%)	59 (55.7)	22 (21.0)	72 (67.9)	24 (22.9)

95% CI	(46.2, 65.1)	(13.2, 28.7)	(59.0, 76.8)	(14.8, 30.9)
P-value	<0.0001			
Peripheral Blood, n (%)	63 (59.4)	42 (40.0)	85 (80.2)	49 (46.7)
95% CI	(50.1, 68.8)	(30.6, 49.4)	(72.6, 87.8)	(37.1, 56.2)
MRD Negativity Rate at Three Months After Completion of Treatment				
Bone marrow, n (%)	55 (51.9)	18 (17.1)	60 (56.6)	17 (16.2)
95% CI	(42.4, 61.4)	(9.9, 24.4)	(47.2, 66.0)	(9.1, 23.2)
Peripheral Blood, n (%)	58 (54.7)	41 (39.0)	65 (61.3)	43 (41.0)
95% CI	(45.2, 64.2)	(29.7, 48.4)	(52.0, 70.6)	(31.5, 50.4)

P-values are from Cochran-Mantel-Haenszel chi-square test. P-value for MRD negativity rate in bone marrow by NGS was the primary MRD analysis.

[a] Based on threshold of 10^{-4} using a next-generation sequencing assay (clonoSEQ)

[b] MRD was evaluated by flow cytometry of peripheral blood or bone marrow per central laboratory. The definition of negative status was <1 CLL cell per 10,000 leukocytes ($<1\times10^4$).

CI = confidence interval; NGS = next-generation sequencing

Twelve months after the completion of treatment, MRD negativity rates in peripheral blood were 49.1% (52/106) by NGS assay and 54.7% (58/106) by flow cytometry in patients treated with IMBRUVICA plus venetoclax and, at the corresponding time point, was 12.4% (13/105) by NGS assay and 16.2% (17/105) by flow cytometry in patients treated with chlorambucil plus obinutuzumab.

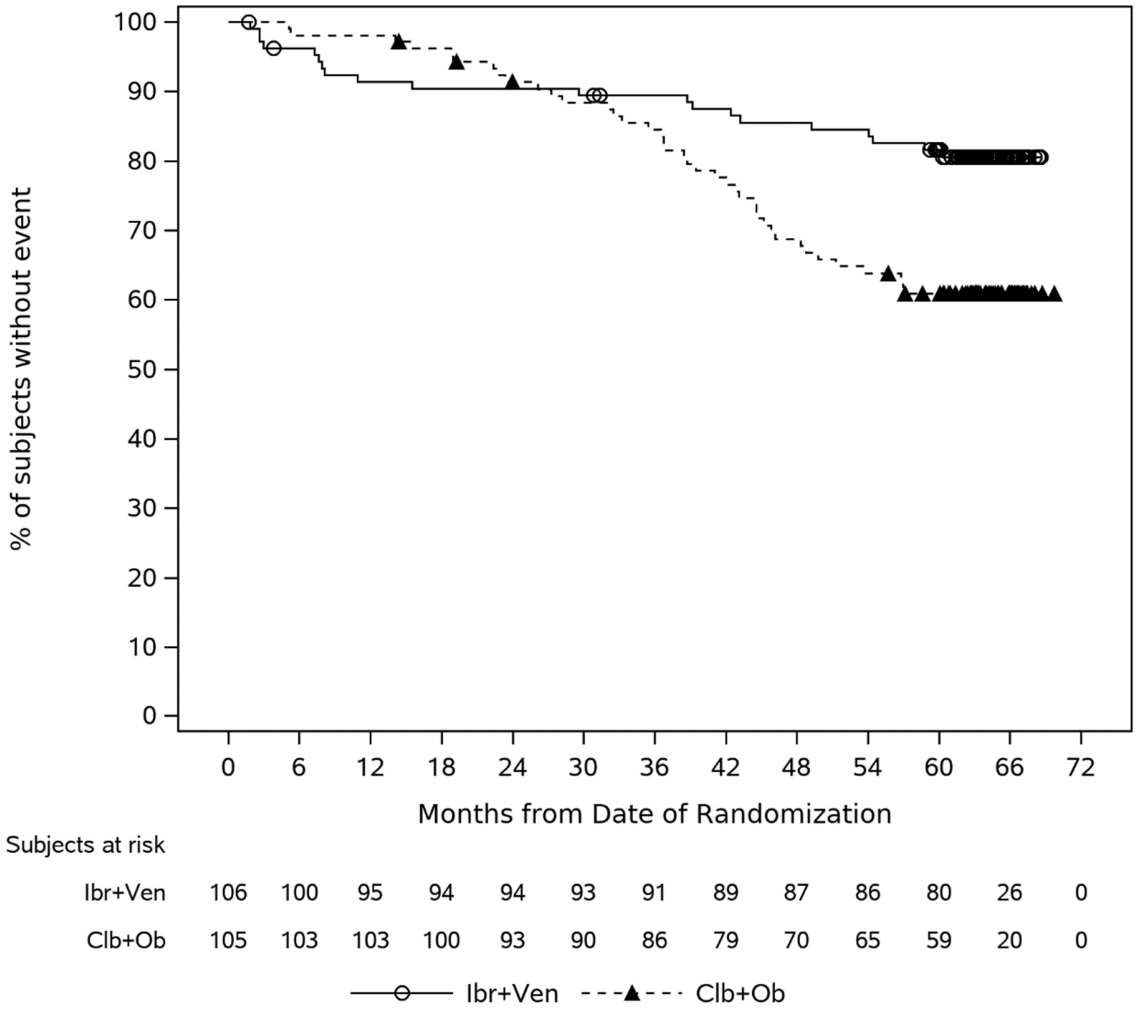
TLS was reported in 6 patients treated with chlorambucil plus obinutuzumab and no TLS was reported in IMBRUVICA in combination with venetoclax.

Median follow-up of 64 months

With a median follow-up time on study of 64.0 months in Study CLL3011, a 73% reduction in the risk of death or progression by investigator assessment was observed for patients in the IMBRUVICA arm. The PFS hazard ratio was 0.267 [95% CI (0.182, 0.393), nominal p<0.0001, not type 1 error controlled]. There were 20 (18.9%) deaths in the IMBRUVICA plus venetoclax arm and 40 (38.1%) in the chlorambucil plus obinutuzumab arm corresponding to a HR of 0.462 (95% CI: 0.269, 0.791, nominal p=0.0039, not type 1 error controlled). Median time to next treatment was not reached for IMBRUVICA plus venetoclax arm and was 65 months for chlorambucil plus obinutuzumab arm (HR=0.233; 95% CI: 0.130, 0.416) with 15.1% of subjects in the IMBRUVICA plus venetoclax arm and 43.8% of subjects in the chlorambucil plus obinutuzumab arm having initiated subsequent anticancer therapy.

Kaplan-Meier curve for OS is shown in Figure 10.

Figure 10: Kaplan-Meier Curve of Overall Survival (ITT Population) in Patients with CLL/SLL in Study CLL3011 at 64 Months Follow-up



The safety and efficacy of fixed duration therapy with IMBRUVICA in combination with venetoclax in patients with previously untreated CLL were further evaluated in a cohort of the phase 2, multi-center, 2-cohort study (PCYC-1142-CA). The study enrolled previously untreated patients with CLL who were 70 years or younger. The study enrolled 323 patients, of these, 159 patients were enrolled to fixed duration therapy consisting of 3 cycles of single agent IMBRUVICA followed by IMBRUVICA in combination with venetoclax for 12 cycles (including 5-week dose titration schedule). Each cycle was 28 days. IMBRUVICA was administered at a dose of 420 mg daily. Venetoclax was administered daily, starting with 20 mg for 1 week, followed by 1 week at each dose level of 50 mg, 100 mg, and 200 mg, then the recommended daily dose of 400 mg. Patients with confirmed progression by IWCLL criteria after completion of the fixed duration regimen could be retreated with single-agent IMBRUVICA.

The median age was 60 years (range, 33 to 71 years), 67% were male, and 92% were Caucasian. All patients had a baseline ECOG performance status of 0 (69%) or 1 (31%). At baseline, 13% of patients had del 17p, 18% with del 11q,

17% with del 17p/TP53 mutation, 56% with unmutated IGHV and 19% with complex karyotype. At baseline assessment for risk of tumor lysis syndrome, 21% of patients had high tumor burden.

After 3 cycles of single-agent IMBRUVICA lead-in therapy, 1% of patients had high tumor burden. High tumor burden was defined as any lymph node ≥10 cm, or any lymph node ≥5 cm and absolute lymphocyte count $\geq 25 \times 10^9$/L.

With a median follow-up time on study of 28 months, efficacy results for PCYC-1142-CA assessed by an IRC according to IWCLL criteria are shown in Table 38, and rates of minimal residual disease (MRD) negativity are shown in Table 39.

Table 38: Efficacy Results in Study PCYC-1142-CA (Fixed Duration Cohort)

Endpoint[a]	**IMBRUVICA + Venetoclax**	
	Without Del 17p (N=136)	**All (N=159)**
Overall Response Rate, n (%)[b]	130 (95.6)	153 (96.2)
95% CI (%)	(92.1, 99.0)	(93.3, 99.2)
Complete Response Rate, n (%)[c]	83 (61.0)	95 (59.7)
95% CI (%)	(52.8, 69.2)	(52.1, 67.4)
Median duration of CR, months (range)[d]	NE (0.03+, 24.9+)	NE (0.03+, 24.9+)

[a] Based on IRC assessment
[b] Overall response = CR + CRi + nPR + PR
[c] Includes 3 patients with a complete response with incomplete marrow recovery (CRi)
[d] A '+' sign indicates a censored observation

CR = complete response; CRi = complete response with incomplete marrow recovery; nPR = nodular partial response; PR = partial response; NE = not evaluable

Table 39: Minimal Residual Disease Negativity Rates in Study PCYC-1142-CA (Fixed Duration Cohort)

Endpoint	**IMBRUVICA + Venetoclax**	
	Without Del 17p (N=136)	**All (N=159)**
MRD Negativity Rate		
Bone marrow, n (%)	84 (61.8)	95 (59.7)
95% CI	(53.6, 69.9)	(52.1, 67.4)
Peripheral Blood, n (%)	104 (76.5)	122 (76.7)
95% CI	(69.3, 83.6)	(70.2, 83.3)
MRD Negativity Rate at Three Months After Completion of Treatment		
Bone marrow, n (%)	74 (54.4)	83 (52.2)
95% CI	(46.0, 62.8)	(44.4, 60.0)
Peripheral Blood, n (%)	78 (57.4)	90 (56.6)
95% CI	(49.0, 65.7)	(48.9, 64.3)

MRD was evaluated by flow cytometry of peripheral blood or bone marrow per central laboratory. The definition of negative status was <1 CLL cell per 10,000 leukocytes ($<1 \times 10^4$).
CI = confidence interval

In patients with del 17p/TP53 mutation (n=27) in PCYC-1142-CA the overall response rate based on IRC assessment was 96.3%; complete response rate was 55.6% and the median duration of complete response was not reached (range, 4.3 to 22.6 months). The MRD negativity rate in patients with del 17p/TP53 mutation 3 months after completion of treatment in bone marrow and peripheral blood was 40.7% and 59.3%, respectively.

No TLS was reported in patients treated with IMBRUVICA in combination with venetoclax.

16.3 Waldenström's Macroglobulinemia

The safety and efficacy of IMBRUVICA in patients with WM were demonstrated in two single-arm trials and one randomized, controlled trial.

Study 1118 and INNOVATE Monotherapy Arm

Study 1118 (NCT01614821), an open-label, multi-center, single-arm trial was conducted in 63 previously treated patients with WM. IMBRUVICA was administered orally at 420 mg once daily until disease progression or unacceptable toxicity. The responses were assessed by investigators and an IRC using criteria adopted from the International Workshop of Waldenström's Macroglobulinemia.

The median age was 63 years (range, 44 to 86 years), 76% were male, and 95% were White. All patients had a baseline ECOG performance status of 0 or 1. The median time since diagnosis was 74 months, and the median number of prior treatments was 2 (range, 1 to 11 treatments). At baseline, the median serum IgM value was 3.5 g/dL (range, 0.7 to 8.4 g/dL).

Responses, defined as partial response or better, per IRC are shown in Table 40.

Table 40: Response Rate and Duration of Response (DOR) Based on IRC Assessment in Patients with WM in Study 1118

	Total (N=63)
Response rate (CR+VGPR+PR), (%)	61.9
95% CI (%)	(48.8, 73.9)
Complete Response (CR)	0
Very Good Partial Response (VGPR), (%)	11.1
Partial Response (PR), (%)	50.8
Median duration of response, months (range)	NE (2.8+, 18.8+)

CI = confidence interval; NE = not evaluable

The median time to response was 1.2 months (range, 0.7-13.4 months).

The INNOVATE monotherapy arm included 31 patients with previously treated WM who failed prior rituximab-containing therapy and received single-agent IMBRUVICA. The median age was 67 years (range, 47 to 90 years). Eighty-one percent of patients had a baseline ECOG performance status of 0 or 1, and 19% had a baseline ECOG performance status of 2. The median number of prior treatments was 4 (range, 1 to 7 treatments). With an overall follow-up of 61 months, the response rate observed in the INNOVATE

monotherapy arm per IRC assessment was 77% (0% CR, 29% VGPR, 48% PR). The median duration of response was 33 months (range, 2.4 to 60.2+ months).

INNOVATE

The INNOVATE study, a randomized, double-blind, placebo-controlled, phase 3 study of IMBRUVICA or placebo in combination with rituximab (NCT02165397), was conducted in treatment naïve or previously treated patients with WM. Patients (n = 150) were randomized 1:1 to receive either IMBRUVICA 420 mg daily or placebo in combination with rituximab until disease progression or unacceptable toxicity. Rituximab was administered weekly at a dose of 375 mg/m^2 for 4 consecutive weeks (weeks 1-4) followed by a second course of weekly rituximab for 4 consecutive weeks (weeks 17-20). The major efficacy outcome measure is progression-free survival (PFS) assessed by an IRC with additional efficacy measure of response rate.

The median age was 69 years (range, 36 to 89 years), 66% were male, and 79% were White. Ninety-three percent of patients had a baseline ECOG performance status of 0 or 1, and 7% of patients had a baseline ECOG performance status of 2. Forty-five percent of patients were treatment naïve, and 55% of patients were previously treated. Among previously treated patients, the median number of prior treatments was 2 (range, 1 to 6 treatments). At baseline, the median serum IgM value was 3.2 g/dL (range, 0.6 to 8.3 g/dL), and MYD88 L265P mutations were present in 77% of patients, absent in 13% of patients, and 9% of patients were not evaluable for mutation status.

An exploratory analysis demonstrated a sustained hemoglobin improvement (defined as increase of ≥ 2 g/dL over baseline for at least 8 weeks without blood transfusions or growth factor support) in 65% of patients in the IMBRUVICA + R group and 39% of patients in the placebo + R group.

With an overall follow-up of 63 months, efficacy results as assessed by an IRC at the time of the final analysis for INNOVATE are shown in Table 41, and the Kaplan-Meier curves for PFS are shown in Figure 11.

Table 41: Efficacy Results in Patients with WM by IRC in INNOVATE (Final Analysis)

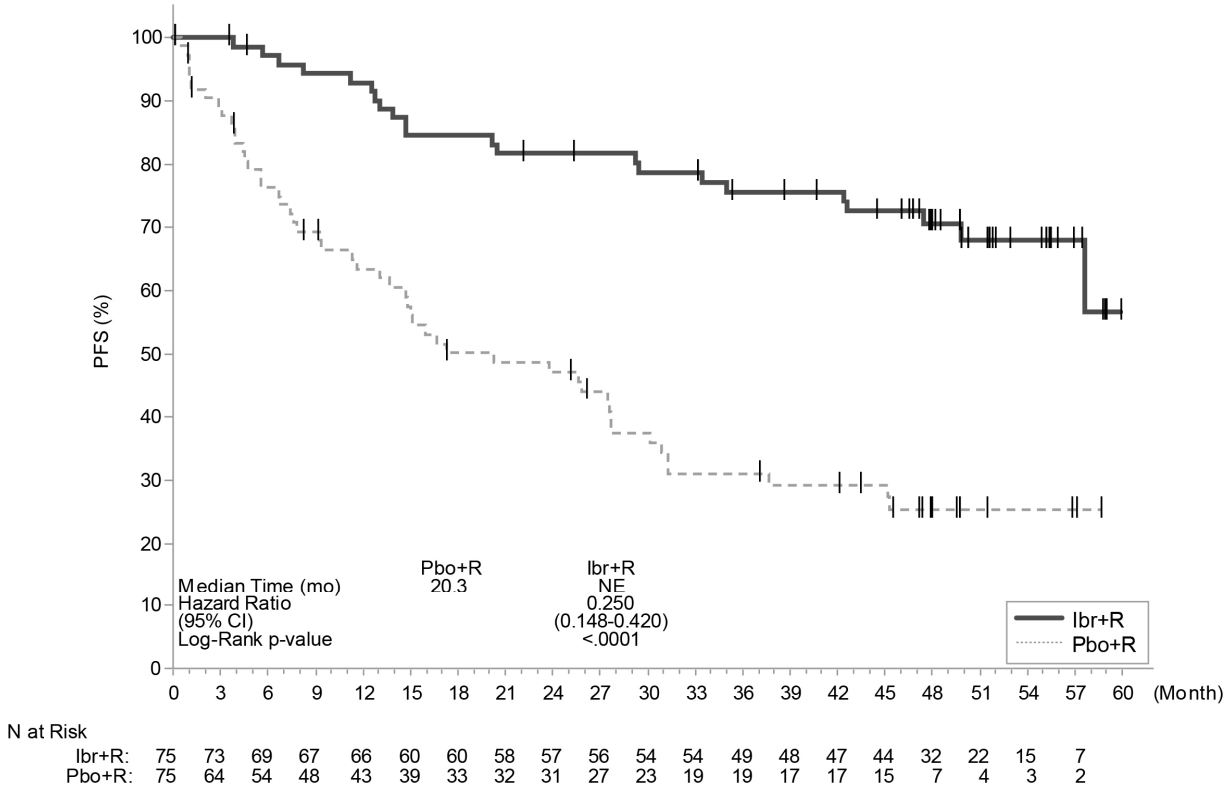
Endpoint	IMBRUVICA + R N=75	Placebo + R N=75
Progression Free Survival		
Number of events (%)	22 (29)	50 (67)
Median (95% CI), months	NE (57.7, NE)	20.3 (13.0, 27.6)
HR (95% CI)	0.25 (0.15, 0.42)	
P-value[a]	<0.0001	
Response Rate (CR+VGPR+PR)[b]	76%	31%
95% CI (%)	(65, 85)	(21, 42)
Complete Response (CR)	1%	1%
Very Good Partial Response (VGPR)	29%	4%
Partial Response (PR)	45%	25%
Median duration of response, months (range)	NE (1.9+, 58.9+)	NE (4.6+, 49.7+)

CI = confidence interval; HR = hazard ratio; NE = not evaluable; R = rituximab

[a] P-value is from the stratified log-rank test

[b] P-value associated with response rate was <0.0001

Figure 11: Kaplan-Meier Curve of Progression-Free Survival (ITT Population) in Patients with WM in INNOVATE



Median overall survival was not reached for either treatment arm. With an overall follow-up of 63 months, 9 (12%) patients on IMBRUVICA + R and 10 (13.3%) patients on placebo + R had died. Forty-seven percent of patients randomized to the placebo + R arm crossed over to receive IMBRUVICA.

16.4 Marginal Zone Lymphoma

The safety and efficacy of IMBRUVICA in MZL were evaluated in Study 1121 (NCT01980628), an open-label, multi-center, single-arm trial of patients who received at least one prior therapy. IMBRUVICA was administered orally at 560 mg once daily until disease progression or unacceptable toxicity. The responses were assessed by investigators and an IRC using criteria adopted from the International Working Group criteria for malignant lymphoma.

The efficacy analysis included 63 patients with 3 sub-types of MZL: mucosa-associated lymphoid tissue (MALT; N=32), nodal (N=17), and splenic (N=14). The median age was 66 years (range, 30 to 92 years), 59% were female, and 84% were White. Ninety two percent of patients had a baseline ECOG performance status of 0 or 1 and 8% had ECOG performance status 2. The median time since diagnosis was 3.8 years, and the median number of prior treatments was 2 (range, 1 to 9 treatments).

Responses per IRC are shown in Table 42.

Table 42: Overall Response Rate (ORR) and Duration of Response (DOR) Based on IRC Assessment in Patients with MZL in Study 1121

	Total (N=63)
Response rate (CR + PR), (%)	46.0%
95% CI (%)	(33.4, 59.1)
Complete Response (CR), (%)	3.2
Partial Response (PR), (%)	42.9
Median duration of response, months (range)	NE (16.7, NE)

CI = confidence interval; NE = not evaluable
Median follow-up time on study = 19.4 months

The median time to response was 4.5 months (range, 2.3 to 16.4 months). Overall response rates were 46.9%, 41.2%, and 50.0% for the 3 MZL sub-types (MALT, nodal, splenic), respectively.

16.5 Chronic Graft versus Host Disease

The safety and efficacy of IMBRUVICA in cGVHD were evaluated in Study 1129 (NCT02195869), an open-label, multi-center, single-arm trial of 42 patients with cGVHD after failure of first line corticosteroid therapy and requiring additional therapy. IMBRUVICA was administered orally at 420 mg once daily. The responses were assessed by investigators using the 2005 National Institute of Health (NIH) Consensus Panel Response Criteria with two modifications to align with the updated 2014 NIH Consensus Panel Response Criteria.

The median age was 56 years (range, 19 to 74 years), 52% were male, and 93% were White. The most common underlying malignancies leading to transplantation were acute lymphocytic leukemia, acute myeloid leukemia, and CLL. The median time since cGVHD diagnosis was 14 months, the median number of prior cGVHD treatments was 2 (range, 1 to 3 treatments), and 60% of patients had a Karnofsky performance score of ≤ 80. The majority of patients (88 %) had at least 2 organs involved at baseline, with the most commonly involved organs being mouth (86%), skin (81%), and gastrointestinal tract (33%). The median daily corticosteroid dose (prednisone or prednisone equivalent) at baseline was 0.3 mg/kg/day, and 52% of patients were receiving ongoing immunosuppressants in addition to systemic corticosteroids at baseline. Prophylaxis for infections were managed per institutional guidelines with 79% of patients receiving combinations of sulfonamides and trimethoprim and 64% receiving triazole derivatives.

Efficacy results are shown in Table 43.

Table 43: Best Overall Response Rate (ORR) and Sustained Response Rate Based on Investigator Assessment[a] in Patients with cGVHD in Study 1129

	Total (N=42)
ORR	28 (67%)
95% CI	(51%, 80%)
Complete Response (CR)	9 (21%)
Partial Response (PR)	19 (45%)
Sustained response rate[b]	20 (48%)

CI = confidence interval

[a] Investigator assessment based on the 2005 NIH Response Criteria with two modifications (added "not evaluable" for organs with non-cGVHD abnormalities, and organ score change from 0 to 1 was not considered disease progression)

[b] Sustained response rate is defined as the proportion of patients who achieved a CR or PR that was sustained for at least 20 weeks.

The median time to response coinciding with the first scheduled response assessment was 12.3 weeks (range, 4.1 to 42.1 weeks). Responses were seen across all organs involved for cGVHD (skin, mouth, gastrointestinal tract, and liver).

ORR results were supported by exploratory analyses of patient-reported symptom bother which showed at least a 7-point decrease in Lee Symptom Scale overall summary score in 24% (10/42) of patients on at least 2 consecutive visits.

17 PHARMACEUTICAL PARTICULARS

17.1 List of excipients

Capsules
Microcrystalline cellulose
Croscarmellose sodium
Sodium lauryl sulfate
Magnesium Stearate
Hard gelatin capsule containing gelatin and titanium dioxide with black printing ink

Colorcon Opacode® Printing Ink Black S-1-17822 and Colorcon Opacode® Printing Ink Black S-1-17823
Shellac Glaze-45% (20% esterified) in ethanol
Iron Oxide Black
n-Butyl Alcohol
2-Propanol
Propylene Glycol
Ammonium Hydroxide 28%

Tablets:
Lactose monohydrate,
Croscarmellose sodium
Microcrystalline cellulose
Povidone
Sodium lauryl sulfate
Colloidal anhydrous silica

Magnesium stearate
Imbruvica 140 mg Tablet: Opadry II Film Coating Powder 85F210036 Green (Polyvinyl alcohol, Titanium Dioxide, Macrogol, Talc, Yellow Iron Oxide, Black Iron Oxide)
Imbruvica 280mg Tablet: Opadry II Film Coating Powder 85F200011 Purple (Polyvinyl alcohol, Titanium Dioxide, Macrogol, Talc, Black Iron Oxide, Red Iron Oxide)
Imbruvica 420mg Tablet: Opadry II Film Coating Powder 85F210036 Green (Polyvinyl alcohol, Titanium Dioxide, Macrogol, Talc, Yellow Iron Oxide, Black Iron Oxide)
Imbruvica 560mg Tablet: Opadry II Film Coating Powder 85F32547 Yellow (Polyvinyl alcohol, Titanium Dioxide, Macrogol, Talc, Yellow Iron Oxide, Red Iron Oxide)

17.2 Shelf life

The expiry date of the product for Capsules and Tablets is indicated on the packaging materials

18 HOW SUPPLIED/STORAGE AND HANDLING

Capsules

The 140 mg capsules are supplied as white opaque hard gelatin capsules, marked with “ibr 140 mg” in black ink, containing off white to white powder and are available in white HDPE bottles with a child-resistant closure and foil induction seal:

- 90 capsules per bottle
- 120 capsules per bottle

Store between 20°C - 25°C

The product should be used within 120 days from first opening

Tablets

The IMBRUVICA (ibrutinib) tablets are supplied in 4 strengths in the following packaging configurations:

- 140 mg tablets: Yellow green to green round tablets debossed with “ibr” on one side and “140” on the other side. Carton of one folded blister card containing blister strips for a total of 30 tablets
- 280 mg tablets: Purple oblong tablets debossed with “ibr” on one side and “280” on the other side. Carton of one folded blister card containing blister strips for a total of 30 tablets
- 420 mg tablets: Yellow green to green oblong tablets debossed with “ibr” on one side and “420” on the other side. Carton of one folded blister card containing blister strips for a total of 30 tablets
- 560 mg tablets: Yellow to orange oblong tablets debossed with “ibr” on one side and “560” on the other side. Carton of one folded blister card containing blister strips for a total of 30 tablets

Do not store above 25°C.

The product should be swallowed whole with a glass of water without opening, breaking or chewing the capsules or cutting, crushing or chewing the tablets approximately the same time each day *[see Dosage and Administration (5.1)]*.

19 MANUFACTURER:

Capsules: Cilag GmBH International, Gubelstrasse 34, 6300 Zug, Switzerland

Tablets: Cilag AG, Hochstrasse 201, Schaffhausen 8200, Switzerland

20 MARKETING AUTHORIZATION HOLDER:

J-C Health Care Ltd., Kibbutz Shefayim 6099000, Israel

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