

Flow-cytometry-identified plasma cell and plasma-cell-neighboring components are associated with disease burden, prognosis and survival in multiple myeloma patients



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Background & Objective
 The microenvironment influences multiple myeloma (MM) persistence and

progression.

· Here we examined various indices in patients and studied their association with disease burden, prognosis and survival.

Methods

Correlations between hematological and biochemical indices and the percentage of clonal PCs, ISS, PFS and OS

	Abs. Basophils [cells/µL]	Abs. Eosinophi [cells/μL	• - •	Abs. Monocytes [cells/µL]	Abs. Neutrophil s [cells/µL]	Platelo [plts/µ		Hb [g/dL]	WBCs [cells/µL]		
% Of PCs in Biopsy	r = 0.14 p-value = 0.3	p-value = p-value =		<i>r</i> = 0.07 p-value = 0.62	r = -0.22 p-value = 0.12	r = 0.0 p-value 0.58	e = p-value =	r=0.03 p-value = 0.83	r = 0.1 p-value = 0.45		
PFS (months)	r = 0.17 p- value=0.27	r = 0.3 p- value=0.0	<i>r</i> = 0.28 p-value = 0.06	<i>r</i> = 0.14 p-value=0.36	r = 0.09 p- value=0.85	r = 0.1 p- value=	p-value =	r = 0.09 p- value=0. 54	r = 0.14 p-value = 0.76		
OS (months)	r = 0.26 p- value=0.07	r = 0.04 p- value=0.7	<i>r</i> = 0.11 p-value=0.47	<i>r</i> = 0.22 p-value=0.14	$r = 0.17$ p^{-} value=0.28 $r = 0$ p^{-} value=0.28		T = 0.03	r = 0.03 p- value=0. 83	<i>r</i> = 0.17 p-value=0.27		
ISS-1 vs. ISS-2/3	0.03 ± 0.02 vs. 0.03 ± 0.03 p-value = 0.66	0.08±0.07 vs. 0.15±0.19 p-value = 0.2	2.02±0.68 vs. 1.8±0.82	0.596±0.27 vs. 0.59±0.34 p-value = 0.98	4.5±3.18	237.86± 1 vs. 198.6±89 p-value 0.15	vs. 9.01 82.67±21.54 e = p-value =	12.0±1.9 vs. 9.84±1.76 p- value=0. 0002	7.95±2.78 vs. 7.12± 3.4 p-value=0.35		
	B2M (mcg	B2M [mcg/mL] LDH		Total Protein [g/dL]	Albumin (g/d	IL]	Ca2+ [mg/dL]	(Cr [mg/dL]		
% Of PCs in Biopsy			r = -0.2 p-value = 0.12 * after exclusion of a single abnormal value r = -0.3 p-value = 0.03	r = 0.3 p-value = 0.03	<i>r</i> = 0.1 p-value = 0.	4	<i>r</i> = 0.07 p-value = 0.6	р	<i>r</i> = -0.24 -value = 0.1		
PFS (months)	<i>r</i> = -0.28 p-value = 0.05				<i>r</i> = 0.36 p-value = 0.0)1	<i>r</i> = 0.35, p-value = 0.03		<i>r</i> = -0.36, p-value = 0.02		
OS (months)	<i>r</i> = 0.25 p-value = 0.1		<i>r</i> = 0.06 p-value = 0.67	r = 0.03 p-value = 0.8	<i>r</i> = 0.33 p-value = 0.0)2	<i>r</i> = 0.3 p-value = 0.07		<i>r</i> = 0.24, p-value = 0.14		
ISS-1 vs. ISS-2/3	2.72±0.75 vs. 8.35±5.35 p-value < 0.001					±0.58 01	9.46±0.58 vs. 9.13± p-value = 0.23	1.05	0.77±0.15 vs. 2.25±1.84 p-value = 0.0016		

- We retrospectively collected relevant hematological and biochemistry indices and flow-cytometry data of bone-marrow (BM) aspirates from 58 patients (F:M [%] 53.4: 46.6, age [mean \pm SD, range] 66.8 \pm 11.63 years, 39-85) at their diagnosis.
- Correlations between determinants and incidences of clonal plasma cells (PCs), international staging system (ISS), progression free survival (PFS) and overall survival (OS) were performed using the JMP software.

Results

Correlations between flow cytometry indices and the percentage of clonal PCs, ISS, PFS and OS

Patients Characteristics			FC Indices of Immune Cells in the Myeloma Microenvironment							Kappa vs. Lambda	CD81	CD27		CD45	CD19	CD56	CD38		Diploid vs.	% Of	
	Average	66.86	Sample Size (n=) Average Standard Deviation Median [range] No				Notes		Lambda Restrictio	(-) vs. (+)	(-) vs. (+)	CD200 (-) vs. (+)	(-) vs. (+)		(-) vs. (+)	(-) vs. (+)		Hyperdipl oid	Proliferating Cells	% PCs in FC	
Age	Average		Total CD45+	30 30	64.57	19.08	[21.12-93.44] 63.8			n	\ +7	\ +7		17	17	17	N T7		olu	Cens	
[years]	Standard Deviation	11.63	Lymphocytes CD45+/SSC low	50	15.26	11.13	[3.57-24.7] 14.85			37.26%±2 6.96 vs.	37.47±28. 53 vs.	49.28±32 .87 vs.	63.33±3 1.57 vs.	42.13 %±31.	41.76%± 29.37 vs.	40.5% ±31.43	10%±10 vs.	100 %	35.64%±30. 92 vs.	r = 0.04 p-value=0.77	r = 0.19 p-value =
	Median [range]	68 [39-85]	Monocytes CD45+/CD64 high/SSC	30	4.3	2.59	[0.75-12.5] 4.15		% Of PCs	42.98±31. 78 p-	43.57±41. 9 p-value	.67 V3. 35.56±28 .26		56 vs. 31.77±	13.67±15	vs. 38.55±	40.86%± 28.7		43.75%±23. 86	p (ulue-ell)	0.16
Sex	Male	27 (47%)	Mature Granulocytes	30	29.75	15.37	[4.7-68.1] 31.41		in Biopsy	value = 0.32	= 0.67	p-value = 0.22	p-value = 0.04	23.84 p-	p-value = 0.1	28.33 p-	p-value = 0.07		p-value = 0.49		
	Female	31 (53%)												value = 0.29		value = 0.82			••••		
Progression Free	Size of Population	48	Immature Granulocytes	30	12.45	10.55	[0.7-42.2] 10.05			41.83±31. 11 vs.	30.53±31. 87 vs.	35.92±36 .24 vs.	64 vs.	23.2±1 9.83 VS.	32.58 ±29.02 vs.	40.55± 36.99 vs.	51.95±22 .9 vs. 32.56	33. 77 +3	26.43±22.19 vs.	0 p-value = 0.96	0 p-value = 0.98
Survival	Average	33.8	CD3+ (Total T-Cells)	30	72.19	12.26	[46.2-94.8] 73.2		PFS	23.17±22. 42 p-	14.48±13. 66 p- value =	23.38±23 .54	3.3		23.15±27	27.39± 22.33	±31.38	1.0 8	42.5 ± 42.61 p-value =		
(PFS) [months]	Standard Deviation	31	CD4+ T-Cells CD8+ T-Cells	30 30	45.24 49.72	15.93 1.85	[2.3-68.7] 45.5 [26.8-81.4] 50.75		(months)	028	0.34	p-value = 0.29	p-value = 0.98	p-	.6 p-value	р-	p-value = 0.3		0.18		
	Median [range]	30 [1-122.9]	CD4+/CD8+ ratio	30	1.03	0.58	[0.08-2.5] 0.87							value = 0.006	= 0.65	value = 0.13					
	Size of Population	47	DP T-Cells	30	1.78	2.66	[0.1-14.1] 0.85											41		r-033	r = 0.08
Overall Survival	Average	41.9	DN T-Cells CD3-/CD56+ (NK Cells)	30 30	4.74	3.3 7.92	[1.4-15.4] 4.05 [1.5-38.5] 8.5			51.28±36. 34 vs.	46 vs.	39.41±37 .69 vs.	30.99±5. 13 vs.	±22.39	.85 vs.	38.02	73.82±30 .71 vs.	41. 88	32.38±29.5 vs.	<i>r</i> = 0.33 p-value 0.06	,p-value = 0.57
(OS)	Standard Deviation	35.58	NKT Cells CD3+/CD56+	30	10.61	6.03	[1.7-26.4] 9.65		05	30.37±27. 33	23.27±15. 88 p-	. 30.71±35 .38 p-value = 0.57	31.14±3 6.26	vs. 65.35±	34.22±43 .25	vs. 35.06±	40.46±35 .41	±3 5.5	63.33±38.35 p-value =		0.57
[months]	Median [range]	35.4 [1-124.5]			FC Indices of P				OS (months)	p-value = 0.04	value = 0.6		p-value	47.82 p-	p-value = 0.79	31.02 p-	p-value = 0.19	0	0.03		
		00.1[1121.0]	% PCs in FC	58	10.67	18.14	[0.4-84.5] 4.26						= 0.99	value =		value = 0.14					
International Staging System (ISS)	Prognostic Groups	50	% Of Proliferating PCs Pleuidy CD138	40	11.06	8.1	[0.96-32.47] 9.75			100.1	100	100 1	100.1	0.003	100 1	100 1	ISS-1		100 1		
	Size of Population Number of Patients with ISS-1	56 26 (46.4%)		40	-		-	80% Diploid (n=32); 20% Hyperploid (n=8)		ISS-1 61.5% vs. 38.5%	ISS-1 70% vs. 30%	ISS-1 46.15% <u>VS.</u> 53.85%	ISS-1 7.7% vs. 92.3%	ISS-1 65% vs. 35%	ISS-1 92% vs. 8%	ISS-1 38.46 vs. 31.5	7.7% vs. 92.3% ISS-		ISS-1 73.7% vs. 26.32%	11.2 ± 7.28 vs. 10.89 ± 9.4 p-value = 0.91	13.6±22.58 vs. 8.69±13.79
	Number of Patients with ISS-2	9 (16%)		Sample Size (n=) 58	Positive	Negative	_		ISS-2/3	ISS-2/3 53.5% vs. 46.5% p-value = 0.55	ISS-2/3 83% vs. 17%	ISS-2/3 50% vs.	ISS-2/3 38.5% vs. 61.5%	ISS- 2/3 74%	(+) 100% vs. 0%	ISS- 2/3	2/3.93.3 vs. 6.7% p-value		ISS-2/3 84.2% vs. 15.8%		p-value = 0.32
	Number of Patients with ISS-3	21 (37.5%)	CD38 CD56	58 57	55 (95%) (66.7%) 38	3 (5%) (33.3%) 19	-				p-value = 0.41	50% p-value = 0.84	p-value = 0.054	vs. 26	p-value = 0.1	27.6% vs. 72.4%	= 0.47		p-value = 0.42		
	Size of Population	25	CD19	51	(8%) 4	(92%) 47	-							value = 0.52		p- value					
Revised International	Number of Patients with R-ISS-1	9 (36%)	CD45 CD200	45 27	(33%) 15 (78%) 21	(67%) 30 (22%) 6	- - -				NK					0.39			Mono	vitae	
Staging System (R-ISS)	Number of Patients with R-ISS-2	15 (60%)	CD27 CD81	30 26	(53%) 16 (23%) 6	(47%) 14 (77%) 20	-	58% Kappa		NKT Cells CD3+/CD	NK Cells CD3- /CD56	DN T- Cells (DP CD T- +/C Cells 8+ ratio	D + T	CD4+	CD3+ Total T Cells	iGr	m(Monoe CD45+ Gr 64 high/3	CD Lymph VCD ytes SSC CD45+	oc Total /S CD45+ w
	Number of Patients with R-ISS-3	1 (4%)	K/L Restriction	55				(n=32) 42% Lambda (n=23)	% Of PCs	56 + r = 0.21 p-value =	+ r= 0.07 p-		r = r = 0.17 0.26	r=	r = 0.2	<i>r</i> = 0.17 p-	r = 0.0 p-value			.22 $r = 0.$	r = 0.17 = p-value
									% Of PCs in Biopsy	0.23	value = 0.67	p- value v	$\begin{array}{ccc} p - & p - \\ alue & valu \\ 0.35 & = 0.1 \end{array}$	e = 0.08	value = 0.26	value = 0.3			.38 0.17	.07	= 0.3
Illust	tration :	High/Low CD-3+ Total	Bone Marrow Compo	onents					PFS (months)	r = 0.32, p- value = 0.12	r = 0.14, p- value = 0.44	0.04, 0 p- value v = 0.8	r = r = 0.28, 0.14 p - p - p - ralue valu = 0.4	$\begin{array}{l} 0.2, p \\ value \\ e = 0.32 \end{array}$	value =	r = 0.24, p- value = 0.23		e p	- p· e=0 value=		e p-value
High/Low CD-4+ T The possible relationship between laboratory findings and disease			Immunophenotype of Plasma Cells CD-45+/CD-45- Kappa/Lambda Disease Burden						OS (months)	r = 0.22, p- value = 0.27	0.33, p-	r = 0.2, p - 0.2, p - 0.36	$ \begin{array}{rcl} r = & r = \\ 0.26, & 0.28 \\ p^{-} & p^{-} \\ value & valu \\ = 0.2 & = \\ 0.17 \end{array} $	$\begin{array}{l} \text{0.1, p}\\ \text{value}\\ \text{e} = 0.56 \end{array}$	value =	0.41, p-	r = 0.17 p-value = 0.43	e p-va	lue p-val	ue = p-value	r = 0.09, p-value = 0.65
				CD-200+/CD-200-		igh/Low	High Low MC		ISS-1 vs. ISS-2/3	9.78±3.58 vs. 11.83±7.72 p- value=0.3 8	.3 vs. 12.98± 10.06	.78 vs5 4.56±3 1. .95 p value v	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	± 9.56 vs. ± 53.95 ± 15.9 $3 p^{-}$ value	9.65 vs. 38.5±17 .5 p- value= 0.05	72.6±9. 83 vs. 70.83±1 4.66 p- value= 0.71	25 vs. 1 11.03±9. p-	±16 .7 VS 29.82 0. 4.72 value	.12 5 ± 3.3 5. value= 2 ± 1 p-	p- vs.	.95 vs. 5. 58.56±17 .98 p-
		High/Low Creatinine		$\overline{}$	High/Low Hb					0.14			e varue L =0.17	,			.9				

Patients Characteristics			FC Indices of Immune Cells in the Myeloma Microenvironment							Kappa vs. Lambda	CD81	CD27		CD45	CD19	CD56	CD38	n	iploid vs.	% Of	
	Average	66.86		Sample Size (n=)	Average	Standard Deviation	Median [range]	Notes		Lambda Restrictio	(-) vs. (+)	(-) vs. (+)	CD200 (-) vs. (+)	(-) vs. (+)	CD19 (-) vs. (+)	CD56 (-) vs. (+)	(-) vs. (+)	CD H 138	yperdipl Pi oid	oliferating Cells	% PCs in FC
Age [years]	Standard Deviation	11.63	Total CD45+ Lymphocytes	30 30	64.57	19.08	[21.12-93.44] 63.8			n											
	Median [range]	68 [39-85]	CD45+/SSC low Monocytes CD45+/CD64 high/SSC	30	15.26 4.3	11.13 2.59	[3.57-24.7] 14.85 [0.75-12.5] 4.15			37.26%±2 6.96 vs. 42.98±31.	37.47±28. 53 vs. 43.57±41.	49.28±32 .87 vs. 35.56±28	1.57 vs.	42.13 %±31. 56 vs.	41.76%± 29.37 vs. 13.67±15	40.5% ±31.43 vs.	10%±10 vs. 40.86%±	%	5.64%±30. 92 vs. p [.] 8.75%±23.	r = 0.04 value=0.77	r = 0.19 p-value = 0.16
	Male	27 (47%)	low						% Of PCs in Biopsy	78 p- value =	9 p-value = 0.67	.26 p-value	9.59 p-value	31.77± 23.84	.17 p-value	38.55± 28.33	28.7 p-value		86 o-value =		
Sex	Female	31 (53%)	Mature Granulocytes	30	29.75	15.37	[4.7-68.1] 31.41			0.32		= 0.22	= 0.04	p- value	= 0.1	p- value	= 0.07		0.49		
Progression Free	Size of Population	48	Immature Granulocytes	30	12.45	10.55	[0.7-42.2] 10.05			41.83±31. 11 vs.	30.53±31. 87 vs.	35.92±36 .24 vs.	26.55±6. 64 vs.	= 0.29 23.2±1 9.83	32.58 ±29.02	= 0.82 40.55± 36.99	51.95±22 .9 vs.	33. 26 77 26	5.43±22.19 vs. p-	0 value = 0.96	0 p-value =
Survival	Average	33.8	CD3+ (Total T-Cells)	30	72.19	12.26	[46.2-94.8] 73.2			23.17±22. 42 p-	14.48±13. 66 p-	23.38±23 .54	26.91±3 3.3	vs. 53.14±	vs. 23.15±27	vs. 27.39±	32.56 ±31.38		2.5±42.61 -value =		0.98
(PFS)	Standard Deviation	31	CD4+ T-Cells	30	45.24	15.93	[2.3-68.7] 45.5		PFS (months)	value=0. 028	value = 0.34	p-value = 0.29	p-value = 0.98	43.37 p-	.6 p-value	22.33 p-	p-value = 0.3	8 1	0.18		
[months]	Median [range]	30 [1-122.9]	CD8+ T-Cells CD4+/CD8+ ratio	30 30	49.72 1.03	1.85 0.58	[26.8-81.4] 50.75 [0.08-2.5] 0.87							value =	= 0.65	value = 0.13					
	Size of Population	47	DP T-Cells	30	1.78	2.66	[0.1-14.1] 0.85							0.006			-			T 0.22	F 0.00
Overall Survival	Average	41.9		30	4.74	3.3	[1.4-15.4] 4.05			$51.28\pm 36.$ 34 vs. $30.37\pm 27.$ 33 p-value = 0.04	46 vs.	39.41±37 .69 vs.		28.213 ±22.39	40.66±33 .85 vs.		73.82±30 .71 vs.	41. 3 88	2.38±29.5 vs. p	r = 0.33-value 0.06	<i>r</i> = 0.08 ,p-value =
(OS)	Standard Deviation	35.58	CD3-/CD56+ (NK Cells) NKT Cells	30 30	10.8	7.92 6.03	[1.5-38.5] 8.5 [1.7-26.4] 9.65		00			30.71±35 .38	31.14±3 6.26	vs. 65.35±	34.22±43 .25	vs. 35.06±	40.46±35 .41	±3 6	9.33±38.35 9-value =		0.57
[months]	Median [range]	35.4 [1-124.5]	CD3+/CD56+		FC Indices of P				OS (months)		value = 0.6	p-value = 0.57	p-value	47.82 p-	p-value = 0.79	31.02 p-	p-value = 0.19	8 -	0.03		
			% PCs in FC	58	10.67	18.14	[0.4-84.5] 4.26						= 0.99	value =		value = 0.14					
	Prognostic Groups		% Of Proliferating PCs	40	11.06	8.1	[0.96-32.47] 9.75			100	***	100		0.003	100	100	*22		****		
	Size of Population Number of Patients	56	Pleuidy	40	-	-	-	80% Diploid (n=32); 20% Hyperploid		ISS-1 61.5% vs. 38.5% ISS-2/3 53.5% vs.	ISS-1 70% vs. 30%	ISS-1 46.15%	ISS-1 7.7% vs. 92.3%	ISS-1 65%	ISS-1 92% vs. 8%	ISS-1 38.46	ISS-1 7.7% vs. 92.3%		2 70/2 VG :	.2±7.28 vs. 10.89±9.4	13.6±22.58 vs.
International Staging System	with ISS-1	26 (46.4%)		Sample Size	Positive	Negative		(n=8)			ISS-2/3 83% vs.	<u>vs.</u> 53.85% ISS-2/3	92.5% ISS-2/3 38.5%	vs. 35%	6% (+) 100% vs.	vs. 31.5 ISS-	ISS- 2/3.93.3 vs. 6.7%		ISS-2/3	value = 0.91	8.69±13.79 p-value =
(ISS)	Number of Patients with ISS-2	9 (16%)	CD138	(n=) 58	-	-	-		ISS-1 vs. ISS-2/3	46.5%	85% VS. 17%	50% vs.	VS. 61.5%	ISS- 2/3 74%	100% VS. 0%	2/3 27.6%	p-value		34.2% vs. 15.8%		0.32
	Number of Patients	21 (37.5%)	CD38	58	55 (95%)	3 (5%)	-			p-value = 0.55	p-value = 0.41	p-value	p-value	vs. 26	p-value = 0.1	vs. 72.4%	= 0.47	ŗ	o-value = 0.42		
	with ISS-3	25	CD56 CD19	57 51	(66.7%) 38 (8%) 4	(33.3%) 19 (92%) 47	-					= 0.84	= 0.054	p- value							
	Size of Population Number of Patients		CD45	45	(33%) 15	(67%) 30	-							= 0.52		p- value 0.39					
Revised International	with R-ISS-1	9 (36%)	CD200 CD27	27 30	(78%) 21 (53%) 16	(22%) 6 (47%) 14	-			NKT	NK		CD	4					Monocyte CD45+/C	S Lympho	
Staging System (R-ISS)	Number of Patients with R-ISS-2	15 (60%)	CD81	26	(23%) 6	(77%) 20	-	58% Kappa		Cells CD3+/CD	Cells CD3- /CD56	DN T- Cells (DP CD T- +/C Cells 8+ rati	$\begin{array}{c} D \\ + T \\ - C \\ \end{array}$		CD3+ Total T Cells	iGr	mGı		ytes	Total CD45+
	Number of Patients with R-ISS-3	1 (4%)	K/L Restriction	55				(n=32) 42% Lambda		56 +	+ r=	r=	r = r =		r = 0.2	r=	r = 0.05	r= 0.1	$\frac{1000}{r} = 0.22$	r = 0.3	<i>r</i> = 0.17
								(n=23)	% Of PCs in Biopsy	p-value = 0.23	0.07 p- value = 0.67	p- value v	$\begin{array}{cccc} 0.17 & 0.2 \\ p & p \\ value & valu \\ 0.35 & = 0.2 \\ \end{array}$	value = 0.08	p- value = 0.26	0.17 p- value = 0.3		p-valu = 0.38	ie p-value = 3 0.178	p-value = 0.07	p-value = 0.3
Bone Marrow Components									PFS (months)	r = 0.32, p- value = 0.12	<i>r</i> = 0.14, p- value = 0.44	r = 0.04, 0.04, 0.04, 0.04, 0.00,	$ \begin{array}{cccc} r = & r = \\ 0.28, & 0.14 \\ p - & p - \\ value & valu \\ = & = 0.4 \end{array} $	r = 0.2, p value $= 0.32$	- 0.13, p- value =	r = 0.24, p- value = 0.23			p-	r = 0.26, p-value = 0.2	r = 0.03, p-value = 0.87
	<u>tration</u> : le relationship	T Cells High/Low Hyperploidy Immunophenotype of Plasma Cells CD-45+/CD-45- Kappa/Lambda Disease Burden						OS (months)	r = 0.22, p- value = 0.27	r = 0.33, p- value = 0.1	r = 0.2, p - 0.2 value = 0.36 V	$\begin{array}{cccc} 0.158 \\ r = & r = \\ 0.26, & 0.28 \\ p^{-} & p^{-} \\ value & valu \\ = 0.2 & = \\ 0.17 \\ \end{array}$	$\begin{array}{ll} 0.1, p \\ value \\ = 0.5e \end{array}$	- p- value =	0.41, p-	r = 0.17, p-value = 0.43		e p-value =	r = 0.28, p-value = 0.79	r = 0.09, p-value = 0.65	
	n laboratory and disease		CD-200+/CD-200-		gh/Low	KHISHITON MA		ISS-1 vs. ISS-2/3	9.78±3.58 vs. 11.83±7.72 p- value=0.3 8	.3 vs. 12.98± 10.06	.95 p- value v	53 vs. 0.4 .16±1 vs. .1 p- 0.81 value 0.5 =0.32 p- valu	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	9.65 vs. 38.5±17 .5 p- value= 0.05	72.6±9. 83 vs. 70.83±1 4.66 p- value= 0.71	25 vs. 11.03±9. p-	±16.12 7 VS. 29.82±	2 5±3.3 p- value=0.1	vs.	.95 vs. 58.56±17 .98 p-	
			High/Low Creatinine			High/Low Hb							=0.	1 =0.17							

	Kappa vs. Lambda Restrictio n	CD81 (-) vs. (+)	CD27 (-) vs. (+)	CD200 (-) vs. (+)	CD45 (-) vs. (+)	CD19 (-) vs. (+)	CD56 (-) vs. (+)	CD38 (-) vs. (+)	CD 138	Diploid vs. Hyperdipl oid	% Of Proliferating Cells	% PCs in FC
	37.26%±2 6.96 vs.	37.47±28. 53 vs.	49.28±32 .87 vs.	63.33±3 1.57 vs.	42.13 %±31.	41.76%± 29.37 vs.	40.5% ±31.43	10%±10 vs.	100 %	35.64%±30. 92 vs.	r = 0.04 p-value=0.77	r = 0.19 p-value =
% Of PCs in Biopsy	42.98±31. 78 p- value = 0.32	43.57±41. 9 p-value = 0.67	35.56±28 .26 p-value = 0.22	33.73±2 9.59 p-value = 0.04	56 vs. 31.77± 23.84 p-	13.67±15 .17 p-value = 0.1	vs. 38.55± 28.33 p-	40.86%± 28.7 p-value = 0.07		43.75%±23. 86 p-value = 0.49		0.16

Red – statistically significant correlation (p≤0.05); Green – possible correlation, not clinically significant (0.05<p<0.1)



These preliminary data raise suggest the clinical relevance

of a combination of PC and PC-neighboring flow-cytometry-

identified biomarkers as indicators of disease burden,

prognosis and survival in MM.

