Does Tumor Necrosis Impact Prognosis in Chondroblastic and Osteoblastic Osteosarcoma? A Study From a Large Tertiary Care Academic Center

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INTRODUCTION: The percentage of tumor necrosis is a crucial prognostic factor in osteosarcoma. Many studies adopt a 90% cutoff based on osteoblastic osteosarcoma, but these findings are generalized to all conventional subtypes, including chondroblastic osteosarcoma. We sought to answer these questions: (1) Is tumor necrosis \geq 90% associated with better overall survival (OS) and disease-free survival (DFS) in osteoblastic and chondroblastic osteosarcoma? (2) Does the osteosarcoma subtype impact tumor necrosis? (3) Does the osteosarcoma subtype in "good" responders (tumor necrosis \geq 90%) affect OS and DFS?

METHODS: We conducted a retrospective study of 156 patients with osteoblastic and chondroblastic osteosarcoma treated at our institution. Propensity-score matching was performed to adjust for potential confounders. Kaplan-Meier survival analysis and Cox proportional hazards modeling were performed.

RESULTS: Patients with osteoblastic osteosarcoma and tumor necrosis \geq 90% had higher five- and ten-year OS and DFS compared to those with necrosis < 90%. In chondroblastic osteosarcoma, a trend towards higher OS and DFS was seen in patients with tumor necrosis \geq 90%; this, however, was not significant. Chondroblastic osteosarcoma was not a risk factor for either tumor necrosis < 90% (p=0.89) or tumor necrosis < 70% (p=0.57). However, patients with age \geq 35 years had an increased 3.87- and 3.2-times higher risk of having a tumor necrosis < 90% and < 70%, respectively. Size \geq 7 cm was also a risk factor for being a "poor" responder, defined as tumor necrosis < 90% or < 70%. Patients with osteosarcoma located in the tibia had a 64% lower risk of being "poor" responders, based on both necrosis < 90% and necrosis < 70%. Patients with osteoblastic or chondroblastic osteosarcoma that were deemed "good" responders (tumor necrosis \geq 90%) had similar OS and DFS at the five- and ten-year marks.

DISCUSSION AND CONCLUSION: Further studies pooling data from multiple institutions are required to determine whether the 90% cutoff is also associated with improved clinical outcomes in chondroblastic osteosarcoma. We additionally recommend that studies include more variables into the propensity-score matching algorithm to have more homogeneous populations and better individualize the impact of histology on response to chemotherapy.

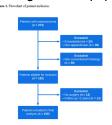


Figure 2. (A) Overall and (B) discuss-free survive creatil and (D) discuss-free survival of patient survival and (T) discuss-free survival of good to \geq 90%.	with shouldehintic estensesons; (ii) evenil
Overall survival of adecidents (15)	Design fee survival of concessors (5)
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		Defere PSM		After PSM			
	Osteoblastic (test23)	Chesdroblastic (to 33)	p	Ostroblantic (n:95)	Chandroblotic (te:M)	P	
Ann (count)*	19 (15-90)	19 (15-60)	0.88	18 (14-37)	18 (15-60)	0.85	
Female ses	51 (41.5%)	7 (21.2%)	6.033	30 (30%)	6 (20%)		
Pathological fracture	33 (27.0%)	4 (12.9%)	0.1	26 (27%)	3 (11%)	0.08	
Book			8.047				
Fener	55 (49.2%)	10 (33,3%)		39 (39%)	10 (33%)		
Tibia	33 (28.0%)	7 (23-3%)		33 (33%)	7 (23%)		
Henexo	13 (11.0%)	5 (16.7%)		13 (13%)	5 (17%)		
Fibralia	4 (3.4%)	0.05.050		4 (450)	0.050		
Other	10 (8.5%)	8 (26.7%)		10 (10%)	\$ (27%)		
Type of surgery			0.067				
Limb salvage	92 (99.1%)	22 (78.6%)		73 (90%)	22 (85%)		
Asspetation	9 (8.5%)	6 (21.4%)		\$ (10%)	4 (15%)		
Sku (co)*	9.5 (8.5-13)	9.8 (5.3-13)	0.77	9 (6-12)	5.9 (6-13)		
M score (AJCC 8th E4.)			0.48			0.6	
340	116 (94.3%)	30 (90.9%)		92 (99%)	27 (90%)		
м	7 (5.7%)	3 (9.2%)		7 (7%)	3 (1816)		
Margin status			0.2			0.25	
Negative (20)	109 (91.6%)	25 (83.9%)		55 (93%)	24 (96%)		
Positive (R1/R2)	10 (5.4%)	5 (16.1%)		7 (7%)	4 (14%)		
RT	11 (8.9%)	4 (12.1%)	0.55	1 (326)	4 (13%)		
QT	109 (88.8%)	29 (17.9%)	0.51	90 (91%)	27 (90%)	0.88	
QT regimen			0.54				
MAP	36 (43%)	10 (38%)		30 (42%)	10 (40%)		
MAPIE	17 (20%)	8 (31%)		17 (24%)	7 (2810)		
IE SI	1.0%	1(4%)		1 (1%)	1(86)		
Other	29 (35%)	7 (27%)		24 (33%)	7 (2916)		
Tumor necrosis (%)	85 (50-96)	80 (30-96)	0.42	85 (50-69)	83 (35-69)		
Follow-up (months)	62 (26-155)	58 (21-143)	0.4	78 (36-062) and stressab	66 (25-156)	0.42	

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		Overall merical			Black for serving			Taran and the same		
		Nonder 98%	Noneight		Supuk+98%	Noneà 1995				
tire reduced	Spen	621169-750	53.43(53.70.5)	6.65	45014-514	759/28.5-64.0	8,896			
	Shreet	511067-918	9543643+3933	6.00	46,09-51-0	68.2 (22-90)	1963	Age ≥ 38		
antherin	Syear	(0.61407-762)	\$42396.1-90.03	6.66	62099-940	753 (349-852)	8.00	Female sex		
	10 year	40(03-90)	95.4 (61.2 - 99.7)	6.60	401(253-563)	60.3 (N - N2.3)	N/C	Pathelogical fracture		
administrativ	Free	267(09-29)	E13 (413 - 191)	6.12	@P(204-0LE)	792/007-91/0	8.12	Bone		
	10 year	36.7(99 - 76)	\$13 (6.3 - 95.1)	6.12	67(01-81)	63.8 (12 - 15.8)	121	Tibia		
								Henry		
								Pitrala		
								Other		
								Type of surgery (Sareline: Limb salva		
								Ampetation.		
								Star > 7 cm		
								M soore (AFCC 8th Ed.)		

	Necresis < 90	Nerroic C 20%		
	HR (99% CI)		BR (85% CI)	,
Age 2.78	3.87 (1.81-11.4)	9.00	82 (128-827)	6.03
Female sex	0.07 (0.35-2.13)	0.76	0.66 (0.25-1.77)	0.43
Pathological fracture	0.96 (0.37-2.47)	0.95	131 (9.5-3.44)	0.50
Bone				
Tibia	0.36 (0.14-0.91)	9.03	0.36 (0.14-0.90)	6.04
Henry	0.6 (0.17-2.12)	0.43	03 (0.851.34)	0.1
Pitola	0.52 (3.05-4.04)	0.53		
Other	0.62 (3.16-2.87)	0.49	0.38 (3.08-2.6)	0.15
Type of surgery (Sareline: Limb salvage)				
Ampetation	1.24 (9.33-4.71)	0.75	3.54 (0.92-13.64)	6.07
Star ≥ 7 cm	6.68 (2.26-19.70)	-K001	3.16 (0.89-18.13)	6.05
M soore (AFCC 8th Ed.)				
MI	1.04(626-4.1)	0.96	0.88 (0.22-8.94)	693
OSA subtype (Baseline: Osteoklastic)				
Checkshietic	0.54 (9.58-2.25)	9.89	1.29 (0.55-3.16)	