Patient Factors Associated with Healing of Scaphoid Proximal Pole Avascular Necrosis

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INTRODUCTION:

Avascular necrosis (AVN) remains a challenging complication following scaphoid fracture. Despite its clinical significance, bone AVN pathophysiology is poorly understood and factors influencing its healing remain poorly characterized. We hypothesize that there are patient specific factors associated with healing of proximal pole AVN following scaphoid fracture.

METHODS:

This is a retrospective review of all patients diagnosed with scaphoid proximal pole AVN secondary to a fracture from January 2018 to November 2024 at a single institution. Patients were grouped by healed AVN or chronic AVN based on radiography and computed tomography (CT) official reports. Patient demographics at time of diagnosis were collected. If the patient underwent scaphoid open reduction internal fixation (ORIF), procedural factors were collected. Univariate analysis was performed to identify factors associated with healing of proximal pole AVN following scaphoid fracture.

RESULTS:

A total of 74 patients met inclusion criteria and were included in this study. 39/74 (52.7%) patients went onto healing of proximal pole AVN. We found that a diagnosis of hypertension (p=0.024) and hyperlipidemia (p=0.028) were significant independent factors associated with chronic AVN. Additionally, advanced age at time of diagnosis (p=0.002) and elevated body mass index (BMI) (p=0.023) were factors associated with lack of AVN healing. There was no significant difference in patient factors including sex, race, scaphoid fracture location (proximal pole, waist, or distal pole), number of alcoholic drinks a week, surgical intervention, and smoking status. For patients who underwent scaphoid fracture with proximal pole AVN ORIF, time between first presentation to hand surgeon and surgery was not significantly associated with healing outcomes, however, a longer tourniquet time was associated with chronic AVN and non-healing (p=0.007).

DISCUSSION AND CONCLUSION:

Our results suggest that hypertension, hyperlipidemia, higher BMI, and advanced age are all patient factors negatively associated with scaphoid proximal pole AVN healing. For patients undergoing scaphoid fracture ORIF, time to surgery was not significantly associated with AVN healing. However, longer tourniquet time during surgery was negatively associated with AVN healing.

Table 1: Demographics of Patients Diagnosed Scaphoid Proximal Pole Avascular Necrosis

	Healed AVN	Chronic AVN	Test Statistic*	P-Value*	Total
Number of cases	39	35	-	-	74
Age (mean ± SD)	29.9 ± 11.9	41.3 ± 17.0	-11.41 (-18.15 to -4.68)	**0.002**	35.3 ±15.5
BMI (mean ± SD)	25.0 ± 3.7	27.3 ± 4.9	-2.34 (-18.30 to -4.53)	**0.023**	26.1 ± 4.4
Sex (n, % male)	32 (82.1)	25 (71.4)	1.18	0.28	57 (77.0)
Race (n, % Caucasian)**	29 (74.4)	19 (54.3)	7.53	0.11	48 (64.9)
Smoking Status (n, % active smokers)	7 (17.9)	7 (20.0)	1.48	0.82	14 (18.9)
Alcohol Use (n, % yes)	25 (64.1)	23 (65.7)	0.02	0.89	48 (64.9)
HTN (n, % yes)	4 (10.3)	11 (31.4)	5.11	**0.024**	15 (20.3)
HLD (n, % yes)	5 (12.8)	12 (34.3)	4.80	**0.028**	17 (23.0)
Laterality (n, % right hand)	16 (41.0)	17 (48.6)	0.43	0.51	33 (44.6)
Fracture on Dominant Hand (n, % yes)	18 (46.2)	18 (51.4)	0.21	0.65	36 (48.6)
Fracture Location (n, % proximal pole)***	11 (28.2)	10 (28.6)	0.91	0.63	21 (28.4)
Surgical Intervention (n, % yes)	30 (76.9)	20 (57.1)	3.29	0.070	50 (67.6)

AVN: avascular necrosis, SD: standard deviation, BMI: body mass index, HTN: hypertension, HLD: hyperlipidemia
BMI measured in kilograms/meters^2
* Categorical variables assessed with either Fisher exact or Chi Square test based on sample size; Continuous variables analyzed with independent samples t-test and reported as mean difference (95% confidence interval). Significance noted with bold text.
** Race classified as Caucasian, Black, Asian, or Hispanic
*** Fracture location classified as proximal pole, waist, or distal pole of scaphoid

Table 2: Surgical Factors Influencing Healing of Scaphoid Proximal Pole Avascular Necrosis

	Healed AVN	Chronic AVN	Mean Difference*	95 % Confidence Interval Lower	Upper	P-Value*
Days between Presentation and Surgery (mean ± SD)	60.52 ± 78.93	90.44 ± 138.07	-29.92	-108.78	48.94	0.382
Tourniquet Time in Minutes During Surgery (mean ± SD)	98.56 ± 31.28	130.94 ± 41.08	-32.38	-55.28	-9.47	**0.007**

AVN: avascular necrosis, SD: standard deviation
*Variables analyzed with independent samples t-test. Significance noted with bold text.