The Sclerotic Hip Index in Patients with Sickle Cell Disease (SHIPS)

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INTRODUCTION: Sickle Cell Disease (SCD) is an autosomal recessive condition that produces numerous Orthopaedic manifestations. One of the most common conditions resulting from SCD is Avascular necrosis of the femoral head, affecting roughly 30% of patients with SCD. Due to this disease process, many SCD patients are required to undergo Total Hip Arthroplasty (THA). It has been previously documented that THA in this patient population is fraught with higher incidence of perioperative complications, making THA in the setting of SCD a challenging prospect. Although there is a known increased risk of perioperative complications in SCD, to our knowledge, no studies have attempted to stratify patients based on the extent of sclerotic changes throughout the proximal femur. Our study aimed to create a Radiographic classification system for SCD to help predict the risk of perioperative complications.

METHODS:

A new classification system was designed to be applied to standard AP Pelvis Radiographs to avoid the need for costly additional imaging. The Sclerotic Hip Index in Patients with Sickle Cell Anemia (SHIPS) classification was divided into three grades based on the distal extent of sclerotic changes within the proximal femur. Grade 1: sclerotic changes in the femoral head and neck, but not distal to the intertrochanteric line. Grade 2: sclerosis distal to the intertrochanteric line, but proximal to the subtrochanteric region. Grade 3: sclerotic changes into the subtrochanteric region of the femur. The patient cohort was obtained from electronic records review of all patients at our institution with a diagnosis code of SCD that received primary THA at a single institute between 2016 and 2023. After reviewing the preoperative radiographs, a final cohort (n=88) was developed. Radiographs were graded by two observers, an attending surgeon and an adult reconstruction fellow blinded to each other`s gradings, grades were compared for inter-observer reliability. Cohorts were created based on the SHIPS grade, surgical outcomes (length of stay, blood loss, blood transfusion, intra-operative and post-operative complications, and 90-day readmission and infection rates) were collected and statistically compared between three groups by Chi-Square and ANOVA tests.

RESULTS:

The inter-observer reliability for the classification system was found to be 91%. 88 subjects were included, cohort sizes were 54,18 and 15 for grades 1,2 and 3, respectively. SHIPS Grade3 cohort had significantly longer LOS compared to groups 1 and 2 (mean LOS: SHIP1:3.63, SHIP2:4.5, SHIP3:10,$p < 0.01$). Patients with more severe SHIP grades had higher rates of pre-operative blood transfusion, higher blood loss (>500ml Blood loss: SHIP1:20%,SHIP2:39%,SHIP3:64%,$p<0.01$) and post-operative blood *transfusions* (SHIP1: 39%, SHIP2:%, 78%, SHIP1:93%, $p<0.01$). No significant difference was observed with regards to infection rates, readmission rates, or Emergency room visits within 90 days (Table 1).

DISCUSSION AND CONCLUSION:

The SHIPS Classification demonstrated excellent inter-observer reliability in this study, indicating it can be used broadly between surgeons. The classification system was also able to show differences in length of stay outcomes and transfusion requirements with high statistical significance. The SHIPS Classification is a simple classification that can be done at a patient's initial visit without any additional cost to the healthcare system. It provides valuable preoperative information to the surgeon and patient, allowing for improved pre-operative patient education and planning of the intra-operative and post operative course.

Column1	Overall	SHIP SCORE-1	SHIP SCORE-2	SHIP SCORE-3	p-value
	n=88	n=54	n=18	n=15	
AGE (mean +/-STDEV)		51.7 ±15.5	41.06 ±16.4	36.93 ± 13.6	**0.01**
Age (Range)		18-73	18-64	19-62	
SEX					**<0.01**
Male	31 (36%)	12 (22.2%)	8(44.4%)	11(73.3%)	
Female	56 (64%)	42 (78%)	10 (56%)	4 (27%)	
LOS (mean +/-STDEV)		3.63± 3.6	4.5 ±3.2	10.2± 10.2	**<0.01**
Pre-Op Narcotics Use	51 (58.6%)	25(46.3%)	16(88.9%)	10(66.7%)	**0.005**
Blood Loss (≥500ml)	26 (32%)	10 (20%)	7 (39%)	9 (64%)	**<0.01**
Blood Transfusion	48 (57%)	20 (39%)	14 (78%)	14 (93%)	**<0.001**
Intra-op Complications	2 (2.4%)	0.00%	2 (11%)	0.00%	NA
DVT/PE (within 1 year)	8 (9.4%)	6 (11.5%)	0	2 (13.3%)	0.3
Infection (within 1 year)	1 (1%)	0	1 (5.6%)	0	0.1
ED-VISITS (3-months)	29 (34.5%)	13 (24.5%)	8 (44.4%)	8 (53.3%)	0.06
Readmission (3-months)	22 (25.9%)	9 (17.3%)	7 (39%)	6 (40%)	0.09
Revision	2	1	0	1	0.4
Mortality	2 (2.4%)	1 (1.9%)	1 (5.6%)	0.00%	0.6