Impact of Knee Osteoarthritis and Arthroplasty on Full Body Sagittal Alignment in Adult Spinal Deformity Patients

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INTRODUCTION:

Hip osteoarthritis (HOA) and total hip arthroplasty (THA) were previously shown to affect sagittal spinopelvic alignment and patient reported outcome measures (PROMS). However, limited studies have examined the impact of Knee osteoarthritis (KOA) and knee arthroplasty (KA) on adult spinal deformity (ASD) patients. This study aims to analyze how full body sagittal alignment parameters and PROMs are affected by KOA and KA.

METHODS:

Patients underwent ASD surgery with pre-operative full-body radiographs were included. OA was graded by two reviewers using the Kellgren Lawrence (KL) classification. In analysis #1: patients were grouped into: bilateral KL<3 (G1), unilateral KL>2 (G2), and bilateral KL>2 (G3). For analysis #2 patients with severe KOA were excluded, and patients were then grouped intopatients with bilateral mild KOA KL<3 (Mild) and patients with unilateral/bilateral (TKA). Patients were propensity-score matched for age, frailty, HOA, PI, and T1PA. Comparative analyses were performed on patient demographics, baseline radiographic sagittal alignment, and/or PROMs (PROMIS, SRS, VR12, ODI). Multivariate regression controlling for age, frailty, PI, T1PA, and KOA, was done to identify independent alignment predictors associated with KOA.

RESULTS:

290 patients in analysis#1 (199 G1, 31 G2, 60 G3), G2 and G3 were older (G1: 50.3, G2:63.3, G3:62.3 years) and G2 were frailer G1 (G1: 2.6, G2:4.1) ($p<0.05$). No difference was observed in sex or comorbidities. On univariate analysis, PT, PI-LL, SVA, sacro-femoral, knee flexion, ankle dorsiflexion angles, pelvic shift, and GSA were significantly worse in G2 and G3 (Figure 1). On multivariate analysis, only knee flexion (R=0.63, β=0.13, p=0.01) and ankle dorsiflexion (R=0.47, β=0.14, p=0.02) angles were independently associated with KOA. In analysis#2 (48 mild OA, 48 TKA), no difference was found in sagittal alignment parameters or PROMs.

DISCUSSION AND CONCLUSION:

ASD patients with severe KOA present with a worse full body sagittal deformity (higher GSA, SVA and PI-LL). However, KOA was only independently associated with greater knee flexion and ankle dorsiflexion. In a matched subanalysis, TKA patients exhibited similar PROMs and radiographic full body alignment vs. patients with mild OA.

Variable	Bilateral non-severe knee osteoarthritis (n=199)	Unilateral severe knee osteoarthritis (n=31)	Bilateral severe knee osteoarthritis (n=60)	p-value
Pelvic tilt	20.7 ± 11.2	26.3 ± 9.5*	27.0 ± 9.2*	<0.001
PI-LL	8.0 ± 23.7	19.6 ± 19.2*	16.3 ± 20.3*	0.005
Sagittal vertical axis	34.7 ± 55.4	65.4 ± 75.0*	51.7 ± 53.1	0.009
Sacro-Femoral angle	203.8 ± 10.5	205.1 ± 11.1	207.4 ± 8.4*	0.047
Knee flexion angle	-0.02 ± 7.3	7.8 ± 9.4*	4.5 ± 8.7*	<0.001
Ankle dorsiflexion angle	2.3 ± 4.0	6.6 ± 4.5*	5.1 ± 4.1*	<0.001
Pelvic shift	13.1 ± 41.8	34.4 ± 42.1*	30.5 ± 46.1*	0.004
Global sagittal alignment	2.1 ± 5.1	5.7 ± 6.4*	4.5 ± 5.4*	<0.001

*: Statistically significant difference when compared to G1 in post-hoc analysis

Figure 1: Results of Univariate comparison in analysis#1 and anteroposterior and Lateral standing radiographs of patients with bilateral mild knee osteoarthritis (A), unilateral severe knee osteoarthritis (B), bilateral severe knee osteoarthritis (C), and bilateral total knee arthroplasty (D).