

A PROSPECTIVE AND PROGRESSIVE SHORT-TERM STUDY OF GAIT ANALYSIS IN POST TOTAL HIP REPLACEMENT SURGERY

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ABSTRACT:

Purpose: To study short-term gait analysis in post total hip replacement patients.

Methods: A prospective analysis of 60 patients, who have undergone total hip replacement. Between august 2019 to July 2021 was performed with minimum follow-up of 6months duration. Gait analysis was assessed using Rivermead Visual Gait Analysis. Study was conducted in 3 intervals of early post-op period, at follow up period of 3 months and 6 months of duration.

RESULTS: The mean was compared with the 50th percentile and 75th percentile and compared with data calculated at 3rd and 6th month of follow-up. **Group 1** subjects showed 25.4% frequency of 22/59 of RVGA score showing a mean of 22 at 50th percentile and showing a mean of 24 at 75th percentile with a baseline measurement of mean 22.678 with standard error of 0.316 with 95% Confidence Interval lower bound being 22.046 and upper bound being 23.310. **Group 2** subjects showed 16.9% frequency of 14/59 of RVGA score showing a mean of 13 at 50th percentile and showing a mean of 15 at 75th percentile with a baseline measurement of mean 13.356 with standard error of 0.312 with 95% Confidence Interval lower bound being 12.731 and upper bound being 13.981. **Group 3** subjects showed 20.3% frequency of 2/59 of RVGA score showing a mean of 3 at 50th percentile and showing a mean of 5 at 75th percentile with a baseline measurement of mean 2.983 with standard error of 0.276 with 95% Confidence Interval lower bound being 2.430 and upper bound being 3.536.

CONCLUSION: After post-total hip replacement, There is a significant decrease in the mean from baseline to 6 months showing improvement after the post op among the patients being followed up. This is more specific when we see the estimates, standard error of the mean given is very small and the confidence interval showing the range between which the error lies is also very narrow, implying error is negligible and significance actually shows the effectiveness of the treatment.

Keywords: Gait, functional outcome, Total hip replacement.

INTRODUCTION

Hip arthroplasty is a replacement procedure of an unhealthy hip with a prosthetic acetabulum and femur head that relieved lot of people from the pain due to hip joint arthritis. The success of this procedure lies in its ability to relieve the pain related to hip joint pathology, while maintain the mobility and stability of the hip joint.^{1, 2} The astonishing success of hip replacement has steered to a rapid rise in the replacement surgeries done. Rise in incidence of chronic disabling conditions of hip such as osteoarthritis, inflammatory arthritis and osteonecrosis among which most common condition for replacement surgery done is severe osteoarthritis of hip which accounts towards seventy percent of total cases. Increased pain and causing limitation in performing daily activities are the primary indication for this procedure. Other common condition where replacement is indicated is for fractures of

neck of femur. Successful total hip mostly depends upon the surgeon to get satisfactory surgical exposure and reducing complications to achieve ideal implant positioning. Various functional tools are available to measure the post-surgical outcome but the most striking for surgeon and patient is the gait. It is interplay between the loss and recovery of balance with constant change in centre of gravity, causing forward propulsion of the body by the lower limbs in systematic, coordinated semi-rotatory movements of the trunk, arm and head. The gait analysis can be done in different ways but most of the methods require electronic instrumented equipments that analysis and quantifies in the form of data which is hard to interpret. In day to day clinical practice requires much simpler and qualitative analysis which can be done early post-operative period and should be able assessing during subsequent post-operative follow up also. Rivermead Visual Gait Analysis (RVGA) is a valid and reliable way of assessing gait and that the RVGA can be used to monitor change in patients even if different therapists are assessing the patient at different times³.

OBJECTIVES

To assess the early and follow up gait functionality in patients who have undergone total hip replacement surgery using a standard reliable clinically approved rivermead visual gait analysis (RVGA) system at early post-operative day one, at 3 months and at 6 months follow up duration.

MATERIALS AND METHODS

Subjects

60 Patients were selected from Sreebalaji medical college ward, post operative ward and OPD including all unit, who have undergone total hip replacement surgeries in the period of 3 years with a minimum follow-up duration of 6 months. Gait analysis was assessed using Rivermead Visual Gait Analysis. Study was conducted in 3 intervals of early post op period, at follow up period of 3 months and at 6 months of duration.

Study design

Patients who have undergone THR were selected from post operative ward for early gait assessment and from outpatient department for assessment at 3 and 6 months of duration, irrespective of the admission units. A qualitative observational gait analysis using RVGA was done for the assessment. Since its an observational analysis, most often it required augmentation with video tapes and record the movements in frontal and lateral views and viewing video tapes in slow motion to accurately delineate the movements.

Subjects were grouped under 3 categories based on the duration as early post operative period when the patient is comfortable and deemed fit for ambulation in 1 or 2 days. At 3 months period of follow up and finally at 6 months follow up post operatively. All the patients underwent standard and focused post operative physical therapy and gait training depending upon the indication of replacement surgery. Follow up radiographs were taken to ensure the post operative remodeling and implant status as well.

Measurements

The RVGA comprises “2 observations of the arms covering both stance and swing of gait, and 18 observations of the trunk and lower limb: 11 observations of the stance phase and 7 of the swing phase of gait. The observations apply to only one side at a time.” “A four-point scale was used to quantify the degree of abnormality for each of the component items: 0 - normal, 1 -mild, 2 -moderate and 3-severe. A global score can be calculated by summing the total numbers of deviation scores, range from 0 (normal gait) to 59 (grossly abnormal gait)”.

Patient is viewed from the front, side, and behind.

The following are noted

- 1) The head position.
- 2) Shoulders - depressed, elevated, protracted, or retracted.
- 3) Amount of arm swing -increased, decreased or normal.
- 4) The trunk -backward or forward lurch or a list to the L or R.
- 5) The pelvis -elevated, level, fixed, or dropped.
- 6) The hip -an adducted or abducted posture extension, flexion, rotation, circumduction.
- 7) The knee - flexion, extension, and general stability.
- 8) The foot - proper push off and pronation and supination.

STATISTICAL ANALYSIS

The gait assessment was done at 3 different intervals depending upon the duration post-surgery as 0, at 3 months and 6 months using RVGA scoring system. We analyzed the scoring in 3 different groups and quantified it accordingly. Assessment was mainly done based on few important parameters of RVGA scoring. After compiling the observational data, frequency of the most common gait was analyzed and mean was calculated [table 1]. This mean was compared with the 50th and 75th percentile and compared with the data calculated at 3rd and 6th month of follow up [table2] . A general linear model was derived that described the estimates and derived baseline measurements of RVGA scoring with mean and standard error with 95% confidence interval which were used in delineating the p value [table5].

RESULT

Group 1 subjects showed 25.4% frequency of 22/59 of RVGA score showing a mean of 22 at 50th percentile and showing a mean of 24 at 75th percentile with a baseline measurement of mean 22.678 with standard error of 0.316 with 95% Confidence Interval lowerbound being 22.046 and upper bound being 23.310[table 4]. These comprised the patients at early post operative period, who require mostly assisted ambulation with rigorous monitored physical therapy with gait training.

Group 2 subjects showed 16.9% frequency of 14/59 of RVGA score showing a mean of 13 at 50th percentile and showing a mean of 15 at 75th percentile with a baseline measurement of mean 13.356 with standard error of 0.312 with 95% Confidence Interval lower bound being 12.731 and upper bound being 13.981[table 4]. These comprised the follow up patients at 3 months post surgery who are still receiving physical therapy especially in the form of gait training.

Group 3 subjects showed 20.3% frequency of 2/59 of RVGA score showing a mean of 3 at 50th percentile and showing a mean of 5 at 75th percentile with a baseline measurement of mean 2.983 with standard error of 0. .276 with95% Confidence Interval lower bound being 2.430 and upper bound being 3.536[table 4].

Mean difference in the study implies the average difference between the baseline, that is from the baseline to 3rd month the difference being 9 units, but the baseline to 6th month is 19 units that means the mean reduced 19 times in 6 months showing better recovery [table 3].

We found that there was a significant difference between the measured mean score at 0- and 6-months period suggesting a fairly poor measurement at 0 months and a significant good to excellent result at the 6 months period.

Table 1: RVGS scoring frequency

RVG S SCO RE	GROUP 1		RVG S SCOR E	GROUP2		RVG S SCOR E	GROUP 3	
	RVGS POST MONTHS	OP 0		RVGS AT 3 MONTHS			RVGS AT 6 MONTHS	
	FREQUEN CY	PERCENTA GE		FREQUEN CY	PERCENTA GE		FREQUEN CY	PERCENTA GE
17	2	3.4	8	1	1.7	0	10	16.9
18	2	3.4	9	1	1.7	1	5	8.5
19	1	1.7	10	6	10.2	2	12	20.3
20	1	1.7	11	6	10.2	3	9	15.3
21	10	16.9	12	9	15.3	4	8	13.6
22	15	25.4	13	7	11.9	5	5	8.5
23	8	15.3	14	10	16.9	6	7	11.9
24	8	13.6	15	7	11.9	7	3	5.1
25	3	5.1	16	5	8.5			
26	3	5.1	17	5	8.5			
27	3	5.1	18	2	3.4			

28	2	3.4						
Total	59	100.0	TOTAL	59	100.0	TOTAL	59	100.0

Table 2 percentile Statistics				
		RVGS post op 0 months	RVGS 3 months	RVGS 6 months
Percentiles	25	21.00	12.00	1.00
	50	22.00	13.00	3.00
	75	24.00	15.00	5.00

Table3 Descriptive Statistics			
	Mean	Std. Deviation	N
RVGS post op 0 months	22.68	2.424	59
RVGS 3 months	13.36	2.398	59
RVGS 6 months	2.98	2.121	59

Table 4 Estimates
MEASURE_1

factor1	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Baseline	22.678	.316	22.046	23.310
RVGS months ³	13.356	.312	12.731	13.981
RVGS months ⁶	2.983	.276	2.430	3.536

Table 5 Pair wise Comparisons

(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	P-Value	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
baseline	RVGS months ³	9.322*	.465	0.037	8.175	10.469
	RVGS months ⁶	19.695*	.411	.028	18.681	20.709

IMMEDIATED POST-OP AFTER THR.



POST –OP – 3 MONTHS OLD GAIT



POST – OP 6 MONTHS OLD GAIT.



DISCUSSION

This small prospective gait study set out to determine the impact of THR on a patient's gait. It was found that patients who underwent THR had significant improvements in their gait pattern, rendering them almost indistinguishable from healthy individuals. Despite significant improvement after surgery, weight acceptance was still statistically less symmetrical than in healthy hip. Studies have demonstrated that while implant choice can affect load transfer through the hipskeletal changes cannot be completely undone.^{4, 5} Our studies suggest that the Rivermead Visual Gait Analysis (RVGA) is a valid and reliable way of assessing gait in patients, and that the RVGA can be used to monitor change in patients even if different therapists are assessing the patient at different times³. Items were chosen on the basis that they were useful, were capable of being observed simply without equipment, and were likely to be reliable. Some items that are considered important were not included. For example, only the most affected leg was observed because, after surgery, changes in the unaffected leg are probably are more of compensatory to the affected leg⁵.

CONCLUSION

Our study analyzed subjects who were early post-operative patients who were assessed ones they were deemed fit for mobilization under strict monitoring as most of the patients were elderly with antalgic gait component and required walking aids. Most striking parameters were found to be upper trunk involvement of shoulder depression, with trunk flexion to the operated side, contra lateral pelvis drop, decreased hip extension and ankle in plantar flexion on stance phase with a decreased hip flexion and trunk flexion during swing phase.

Those who were assessed after 3 months rigorous, intermittently monitored and supervised focused physical therapy and gait training who performed well with parameters of contra lateral pelvis drop, reduced hip extension and occasional reduction in hip flexion. Patients usually were found to be self-ambulating under supervision but still used walking aids especially when they ambulate alone.

Patients who were seen at 6 months of follow up and most often found to walk in the OPD independently on their own, who required minimum support and were self-ambulating on regular surfaces.

There is a significant decrease in the mean from baseline to 6 months showing improvement after the post op among the patients being followed up. This is more specific when we see the estimates, standard error of the mean given is very small and the confidence interval showing the range between which the error lies is also very narrow, implying error is negligible and significance actually shows the effectiveness of the treatment.

CONFLICT OF INTEREST: None

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