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Outcomes of Revision of Total Hip Arthroplasty in Patients in Secondary Care Hospital

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Key Words:
Total hip arthroplasty, outcomes, aseptic loosening, infections.

Background: Although total hip arthroplasty is a popular surgery, little is known about its outcomes.
Aim of the study: The purpose of this study was to investigate the demographics and outcomes of patients receiving primary and revision total hip arthroplasty in terms of their impact on hospital and surgeon resource use and referral patterns to a secondary care hospital.
Methods: Clinical, demographic, and economic data were collected for forty-eight consecutive patients with an infection following a total hip replacement who underwent a two-stage revision arthroplasty (Group 1) performed by one of two surgeons between January 1, 2022 and December 1, 2024, at the Department of Orthopaedics & Traumatology, TMSS Medical College & Rafatullah Community Hospital (TMC & RCH), Bogura, Bangladesh, Uttara Adhunik Medical College and Hospital, Uttara, Dhaka., Bangladesh & Enam Medical College Hospital, Savar, Dhaka, Bangladesh. During the same time period, data were collected for a cohort of 48 patients who received revision of both components due to aseptic loosening (Group 2) and 48 patients who underwent primary hip arthroplasty (Group 3).

Results: Revisions for infection resulted in longer operational times, more blood loss, and more complications compared to revisions for aseptic loosening or original total hip arthroplasty ($p < 0.02$). Revisions for infection were linked to increased hospitalizations, days in the hospital, operations, costs, outpatient visits, and charges within a year of the index procedure ($p < 0.001$). Over a five-year period, our institution saw a significant increase in referrals for infection after total hip arthroplasty (Spearman rank correlation, 1.0; $p = 0.0083$). However, referral rates for revision for other reasons remained relatively constant (Spearman rank correlation, 0.500; $p = 0.3910$).

Conclusion: Infections after total hip arthroplasty require significantly more hospital and medical resources than revisions due to aseptic loosening or original total hip arthroplasty.

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INTRODUCTION

Total hip arthroplasty is a safe and effective treatment option for individuals with severe degenerative joint condition [1, 2]. This procedure's performance has increased dramatically in recent years, both in the United States and internationally [3, 4]. There is a general belief that increased expertise with total hip arthroplasty has resulted in better patient outcomes, as has been found in other surgeries [5, 6], but rigorous empirical data confirming such improvement is few [7, 8]. This absence of data is surprising given that an estimated 280 000 total hip arthroplasty surgeries are performed each year at a cost of more than $12 billion [4]. Despite efforts to regionalize surgical procedures to higher-quality institutions, there has been no comprehensive examination of total hip arthroplasty results [9]. Total hip arthroplasty, which is typically an elective surgery, should be amenable to regionalization. Furthermore, the Medicare prospective payment system, which went into effect in 1983, provides hospitals with an incentive to minimize expenditures [10]. Infection after total hip arthroplasty has significant economic implications for patients, payers, hospitals, physicians, and society, including direct medical costs, resource utilization, and indirect costs such as lost wages and productivity. Providing care for patients with infections after arthroplasty can be costly due to inadequate reimbursement for hospitals and physicians [11]. This is especially true for high-volume secondary-care referral centers where patients are frequently referred for definitive care. This study aimed to compare resource utilization for patients undergoing primary total hip arthroplasty, revision total hip arthroplasty for aseptic loosening, and revision total hip arthroplasty for infection. It also evaluated trends in infection referral patterns at a secondary-care referral hospital. The research investigation aimed to determine if revision total hip arthroplasty for infection requires more hospital and surgeon resources than original or revision total hip arthroplasty for aseptic loosening.

METHODOLOGY

This study used a retrospective cost-identification cohort design. Clinical, demographic, and economic data were collected for forty-eight consecutive patients with an infection following a total hip replacement who underwent a two-stage revision arthroplasty (Group 1) performed by one of two surgeons between January 1, 2022 and December 1, 2024, at the Department of Orthopaedics & Traumatology, TMSS Medical College & Rafatullah Community Hospital (TMC & RCH), Bogura,

Bangladesh, Uttara Adhunik Medical College and Hospital, Uttara, Dhaka., Bangladesh & Enam Medical College Hospital, Savar, Dhaka, Bangladesh. During the same time period, data were collected for a cohort of 48 patients who received revision of both components due to aseptic loosening (Group 2) and 48 patients who underwent primary hip arthroplasty (Group 3). Referral patterns were investigated by analyzing the initial diagnosis of all patients sent to our institution for revision total hip arthroplasty over a five-year period. Quantitative factors were compared between patient groups using Kruskal-Wallis nonparametric rank test. All data was collected, documented in a Microsoft Excel work sheet, and analyzed using descriptive statistics in SPSS 16.0.

RESULT

Table-1 displays the differences in baseline clinical and demographic characteristics among the groups. There were no significant variations in patient age or BMI across the three groups based on available data ($p > 0.3$). Group 1 had more men ($p = 0.0090$), while Groups 1 and 2 had higher medical severity of illness scores (a measure of baseline comorbid disease) and a higher prevalence of significant femoral and acetabular bone loss ($p < 0.001$) compared to Group 3 who had primary total hip arthroplasty. Table-2 summarizes the clinical outcomes. Significant differences were identified between the revision groups (Groups 1 and 2) and the primary group (Group 3) in terms of surgical time and blood loss ($p < 0.001$). The group with an infection (Group 1) had considerably higher estimated blood loss and consequences compared to Group 2, which had revision due to aseptic loosening ($p < 0.02$). Group 2 had more issues than Group 3, although the difference was not statistically significant ($p = 0.36$). Table-3 compares hospital and physician resource consumption per patient. Hospital expenditures for revision total hip arthroplasties (Groups 1 and 2) were substantially higher than those for primary arthroplasty (Group 3) ($p < 0.001$). There were significant disparities among the three groups in terms of hospitalizations and days spent in the hospital. During the episode of care, total hospital operations, expenses, outpatient visits, and charges were recorded. Group 1 had considerably higher resource use for all variables compared to Groups 2 and 3 ($p < 0.001$). Table-4 depicts trends in referral patterns to our secondary care hospital for patients requiring revision total hip arthroplasty. Patients referred for revision total hip arthroplasty had a higher rate of infection after surgery. The percentage increased from 5% (three out of fifty-nine) in 2020 to 17% (fifteen out of eighty-seven) by 2024. During this time period, there was no significant increase in the number of patients referred for revision total hip arthroplasty for reasons other than infection (Spearman rank correlation, 0.500; $p = 0.3910$). However, the number of patients referred for revision total hip arthroplasty due to infection increased fourfold (Spearman rank correlation, 1.00; $p = 0.0083$).

Table-1: Baseline clinical and demographic characteristics of patients

Characteristics	**Group 1 (Revision Arthroplasty for Infection) (N = 48)**	**Group 2 (Revision Arthroplasty for Aseptic Loosening) (N = 48)**	**Group 3 (Primary Arthroplasty) (N = 48)**	**P Value**			
				Overall	**Comparison of Groups l and 2**	**Comparison of Groups l and 3**	**Comparison of Groups 2 and 3**
Age (in years) [Mean ± SD]	54.7 ± 14.109	62.9 ±13.5	53.5 ± 15.0	0.33	0.15	0.63	0.32
Gender Women Men	 11 37	 27 21	 28 20	 0.009	 0.014	 0.016	 1.00
Body mass index [Mean ± SD]	24.2 ±6.2	24.7 ±6.7	24.7 ±5.5	0.99	0.99	0.99	0.82
APR-DRG SOI scoret (no. of hips) 1 2 3 4	 2 27 17 2	 2 28 18 0	 22 22 4 0	 <0.001	 0.80	 <0.001	 <0.001
Acetabular deficiency (no. of hips)	43	40	9	<0.001	0.17	<0.001	<0.001
Femoral deficiency (no. of hips)	38	32	14	<0.001	1.00	<0.001	<0.001

Table-2: Clinical outcomes for infection

Characteristics	**Group 1 (Revision Arthroplasty for Infection) (N = 48)**	**Group 2 (Revision Arthroplasty for Aseptic Loosening) (N = 48)**	**Group 3 (Primary Arthroplasty) (N = 48)**	**P Value**			
				Overall	**Comparison of Groups l and 2**	**Comparison of Groups l and 3**	**Comparison of Groups 2 and 3**
Operating-room Time (min) [Mean ± SD]	274.8 ± 73.3	297.9 ± 78.6	58.5 ± 15.0	<0.001	0.27	<0.001	<0.001
Estimated blood loss (mL) [Mean ± SD]	2072±1547	1549 ±1318	449 ± 99	<0.001	0.015	<0.001	<0.001
Total no. of complications per patient [Mean ± SD]	1.9 ±2.2	0.7 ± 1.0	0.5 ±0.7	0.004	0.019	0.002	0.36

Table-3: Resource utilization per patient

Characteristics	**Group 1 (Revision Arthroplasty for Infection) (N = 48)**	**Group 2 (Revision Arthroplasty for Aseptic Loosening) (N = 48)**	**Group 3 (Primary Arthroplasty) (N = 48)**	**P Value**			
				Overall	**Comparison of Groups l and 2**	**Comparison of Groups l and 3**	**Comparison of Groups 2 and 3**
No. of hospitalizations	3.4 ±2. 1	1.1 ±0.5	1.2 ±0.4	<0.001	<0.001	<0.001	0.85
Total no. of days in hospita	28.2± 20.9	8.1 ± 5.3	6.2 ±2.4	<0.001	<0.001	<0.001	0.38
Total no. of	3.690 ±	1.407 ±	1.0 ±0.2	<0.00	<0.001	<0.001	0.032

operations	2.222	0.888		1			
Total hospital costs (US$)	96,166 ± 60,664	34,866 ± 15,547	21,654 ± 4291	<0.001	<0.001	<0.001	<0.001
No. of outpatient visits	54.6 ± 35.1	28.2 ± 27.6	17.2 ± 11.8	<0.001	<0.001	<0.001	0.16
Total outpatient charges (US$)	48,348 ± 27,965	16,411 ± 9478	8519 ± 4185	<0.001	<0.001	<0.001	<0.001

Table-4: Number of patients referred to our secondary-care hospital between 2020 and 2024 for infection

Year	All Revision Total Hip Arthroplasties	Revision Arthroplasty for Aseptic Causes	Revision Arthroplasty for infection	Percentage of Revision Arthroplasties for Infection
2020	59	56	3	4
2021	81	74	7	9
2022	79	70	9	11
2023	91	79	12	13
2024	87	72	14	17
Spearman rank correlation (95% confidence interval)	0.800 (-0.28 to 09.986)	0.500 (-0.684 to 0.959)	1.000 (0.936 to 1.000)	
Spearman p value	0.1041	0.391	0.0083	

DISCUSSION

Our study found that revision total hip arthroplasty due to infection costs 2.8 times more than revision total hip arthroplasty due to aseptic loosening and 4.8 times more than revision total hip arthroplasty due to any other reason. Costs for primary total hip arthroplasty. Infection-related revisions of total hip arthroplasty resulted in significantly higher hospitalizations. Revisions for aseptic loosening or original total hip arthroplasty resulted in fewer hospital days, surgeries, outpatient visits, expenses, and problems. Infection rates after total hip arthroplasty vary between 0.5% and 7.5% [12, 13]. Infection risk factors vary according on patient, operation, surgeon, and hospital features. Risk factors for infection after total hip arthroplasty

include rheumatoid arthritis, diabetes, poor nutrition, obesity, sickle-cell disease, previous solid organ transplant, use of oral steroids, immune system compromise, and history of joint surgery (14, 15). Factors such as timing and dosage of perioperative antibiotics, surgical technique, soft tissue handling, operating-room traffic, and reconstruction intricacy can all increase the risk of infection after surgery [12, 14]. Recent studies indicate an inverse relationship between hospital and surgeon volume and infection rates after total joint arthroplasty [16]. Several researchers have attempted to evaluate the economic cost of infection following total joint arthroplasty [17]. Scuico [18] calculated the economic burden of infection following complete joint replacements at The Hospital for Special Surgery in New York. Based on Medicare data from 1986 to 1989, the prevalence of infection after total joint arthroplasty in the US was estimated to be 3500 to 4000 cases per year, with an average cost of $50,000 to $60,000 per case, totaling $150 million to $200 million per year. Hebert et al. [19] analyzed direct medical expenses for patients undergoing primary total knee arthroplasty, revision total knee arthroplasty due to aseptic loosening, and revision total knee arthroplasty due to infection. The study found that treating patients with an infection after total knee arthroplasty required three to four times the resources of the hospital and surgeon compared to a primary procedure, and approximately twice those required for revision total knee arthroplasty due to aseptic loosening. Insufficient reimbursement led to an estimated net loss of $15,000 per patient and $30,000 per Medicare patient. Our study expands on past research by utilizing a bigger sample size, longer follow-up, and comprehensive resource consumption data across a 12-month period of treatment. Our analysis uses actual hospital prices from our decision support system, unlike other studies that rely on billed charges or cost-to-charge ratios to assess resource consumption across operations [19, 20]. Our study's primary strength is that it accurately measures health-care resource utilization, despite the fact that the economic basis of charges varies significantly across facilities and locations [21-22].

Limitation of the study:

The study featured a single focus point and minimal sample sizes. As a result, the study's conclusions may not completely reflect the entire situation.

CONCLUSION & RECOMMENDATION

Infections after total hip arthroplasty require significantly more hospital and medical resources than revisions due to aseptic loosening or original total hip arthroplasty. We believe that the lack of incremental reimbursement for these operations creates financial disincentives for physicians and hospitals to treat patients with infections following total hip arthroplasty.

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