Analysis Of Clinical Pathway Compliance In Arthroplasty Cases At Secondary Referral Hospitals In South Sulawesi

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Abstract

Background:
Clinical pathways (CPs) are structured, evidence-based multidisciplinary care plans designed to standardize medical management, improve clinical outcomes, and optimize healthcare efficiency. In Indonesia, CPs are aligned with the National Health Insurance system and the INA-CBGs payment model, requiring hospitals to ensure cost-effective and high-quality care. Arthroplasty procedures, often associated with substantial clinical and financial burdens, benefit from CP implementation. However, data on CP compliance, particularly in secondary referral hospitals in South Sulawesi, remain limited. Evaluating CP adherence in arthroplasty cases is essential to assess its impact on patient outcomes and healthcare costs.

Objective:
To evaluate the level of compliance with clinical pathways in arthroplasty procedures at a secondary referral hospital and to analyze its impact on patient outcomes and medical service costs.

Methods:
This was a cross-sectional analytical study using retrospective data from 75 patients who underwent arthroplasty procedures at Hasanuddin University Hospital between November 2019 and May 2024. Compliance with clinical pathway indicators—including medical assessment, diagnostic tests,

procedures, medication, pharmaceutical assessment, rehabilitation, consultation, and discharge planning—was evaluated using electronic medical records. Data were analyzed using descriptive statistics and chi-square tests to assess the relationship between pathway compliance and medical costs.

Results:
Of the 75 arthroplasty cases analyzed, full compliance with all clinical pathway indicators was observed in 38.7% of patients, while 61.3% showed non-compliance. Diagnostic tests, medication, pharmaceutical assessment, rehabilitation, and consultation indicators had 100% compliance. However, lower compliance was noted in medical assessment (38.7%), medical procedures (72%), and discharge planning (61.3%). A significant association was found between pathway compliance and medical service costs, with non-compliance linked to higher costs ($p < 0.0005$).

Conclusion:
Adherence to clinical pathways in arthroplasty cases is associated with reduced length of stay and lower medical service costs. While several indicators demonstrated full compliance, gaps remain in medical assessment, procedures, and discharge planning. Strengthening pathway implementation can enhance care quality and cost-efficiency in secondary referral hospitals.

Introduction

Background

A clinical pathway (CP) is a multidisciplinary approach that emphasizes prompt, sustainable, and resource-efficient patient care for patients with a particular diagnosis or procedure. A CP will help the hospital develop a patient care plan to increase efficiency, preserve quality, and keep costs under control. This CP is based on the government's National Health Insurance program, which has been in place since January 2014 and is administered by the Social Security Agency on Health. The Indonesia Case Based Groups (INA-CBGs) system is used to pay medical costs for government insurance patients in secondary referral health facilities. Hospital management must optimize finances, cut costs, and ensure quality control to implement the INA-CBGs package rate.[1]

According to a review of research findings in several nations, clinical pathways implementation can improve cost-effectiveness and shorten the average length of stay (LOS). Numerous studies demonstrate the advantages of implementing CP, including those by Feagan (2001) on promoting early discharge and raising the quality of life index and Darer et al. (2002), which found that CP decreases LOS, improve clinical outcome and economic outcomes, also decrease needless actions.[2,3] A clear understanding of input, process, output, and outcome is crucial for implementing CP in hospitals. Evaluation methods include assessing structure, activities, and results.[5] Hospitals are expected to adopt pathways that meet Integrated Clinical Pathway Appraisal Tools (ICPAT) requirements to improve service quality.[6]

A study by Pina et al. (2011) on the incidence of arthroplasty from 31 nations found that in 2007, the incidence rate for total knee replacement (TKR) was 104. 3 per 100,000 people, while for total hip replacement (THR), it was 118. 8 per 100,000.[7] This is consistent with previous studies on the use of CP in arthroplasty cases as the use of CP in arthroplasty reduced hospital stays and costs without readmissions and showed better compliance.[8,9] In the meantime, no examination of adherence to the clinical pathway implementation for arthroplasty cases has ever been conducted at a secondary referral hospital in South Sulawesi, making it of interest to researchers.

Methodology

This study employs a quantitative, non-experimental analytical (observational) design with a cross-sectional approach, utilizing retrospective data collected from November 2019 to May 2024. The authors

evaluate the compliance level of clinical pathway implementation in arthroplasty (Table 1) using the electronic medical records. The study protocol was reviewed and approved by an Institutional Review Board (IRB) or an independent ethics committee, and informed consent was obtained from all participants.

Results

The general characteristics of this research sample have been classified based on age, gender, length of stay, type of surgery, and outcome status of each patient recorded in the electronic medical record, which are described in Table 2. There were 75 patients' medical records. Table 2 indicates that the most common age groups were 56–65 and 66–75 years (32% each), while the 26–45 age group had the lowest percentage (8%). Female patients predominated (72%), compared to 28% male. The longest LoS category was 5–10 days (49.3%), followed by 1–4 days (38.7%), 11–20 days (10.7%), and 21–30 days (1.3%). Surgical procedures included total hip arthroplasty (38.7%), total knee arthroplasty (38.7%), and bipolar hemiarthroplasty (22.7%). Regarding recovery, 61.3% had LoS ≥ 5 days, while 38.7% recovered within the hospital's arthroplasty clinical pathway (< 5 days).

Overview of compliance level of clinical pathway implementation in arthroplasty cases at secondary referral hospital

Medical assessment and monitoring indicators

Table 3 shows the compliance level with medical assessment and monitoring indicators in clinical pathway arthroplasty. Of the 75 patient records, compliance was 38.7%, while non-compliance was 61.3%.

Diagnostic test indicators

The research results show compliance with diagnostic test indicators in the clinical pathway for arthroplasty, as detailed in Table 3, which indicates that 100% of the 75 patient medical records complied with the diagnostic test indicators.

Medical procedures

Based on the research results, the level of compliance with medical action indicators in clinical pathway arthroplasty can be described in Table 3. The results showed that the percentage of compliance was 72% and non-compliance was 28%.

Medication

Based on the research results in Table 3, compliance with medication indicators in clinical pathway arthroplasty shows a 100% rate based on 75 samples.

Pharmaceutical assessment indicator

The level of compliance with pharmacy assessment indicators in clinical pathway arthroplasty is shown in Table 3. The results from 75 patient medical records indicate a compliance percentage of 100%.

Rehabilitation and mobilization indicator

Based on research results, the level of compliance with rehabilitation and mobilization indicators in clinical pathway arthroplasty can be described in Table 3, which shows a compliance percentage of 100%.

Consultation and communication indicator

The level of compliance with consultation and communication indicators in clinical pathway arthroplasty can be described in Table 3, which shows the percentage of compliance with clinical pathway implementation of 100%.

Discharge plan indicator

Based on the research results, the level of compliance with plan indicators discharges in clinical pathway arthroplasty described in Table 3 shows that the compliance rate was only 61.3%.

Compliance level of clinical pathway on the arthroplasty patients.

Based on Table 4, 29 medical records (38.7 %) complied with all parameters evaluated on arthroplasty CP, while 46 medical records (61.3%) did not.

Implementation of arthroplasty CP on medical cost

Compliance of clinical pathways with real costs of patient services at a secondary referral hospital is shown in Table 5. For costs less than 40 million rupiahs, 54 patients were assessed; 29 complied with CP, while 25 did not comply with CP. For costs over 40 million, all 21 patients did not comply with CP. The chi-square test result shows a significant relationship between compliance with clinical pathway implementation and medical cost, with a significance value of 0.000 (p-value < 0.0005).

Tables

Table 1. Clinical Pathway of Arthroplasty

Admission Day	1	2	3	4
Medical Assessment and Monitoring	History taking and physical examination, including pain scale, BMI, knee or hip examination, gait analysis, and range of motion. Decide the diagnosis and treatment plan for the patient	Surgery is performed Monitoring of pain scale Monitoring of early complications (bleeding, open wounds), monitoring of post-operative effects, post-operative wound care, practice mobilization	Monitoring of pain scale Monitoring of early complications (bleeding, open wounds), monitoring of post-operative effects, post-operative wound care, practice mobilization	Monitoring of pain scale The patient is discharged on the 3rd day after surgery if there are no complications and the patient can mobilize with an assistive device
Diagnostic Test	CBC, Naso/oropharyngeal swab for RT-PCR, Chest X-ray, Pelvis X-ray/Hip X-ray/Femur X-ray/Knee X-ray	Post-operative CBC and X-ray on the surgery site.		
Medical Procedure	Consent for operation	Wound dressing	Wound dressing	Wound dressing

			Foley catheter and wound drain removal	
Medication		- Antibiotic Prophylaxis (Ceftriaxone 2 gr iv) - Ketorolac 30 mg iv / 8 hours - Ceftriaxone 1 gr/iv/12 hours - Ranitidine 50 mg/iv/8 hours)	- Ketorolac 30 mg iv / 8 hours - Ceftriaxone 1 gr/iv/12 hours - Ranitidine 50 mg/iv/8 hours)	Oral antibiotics and analgesic
Pharmaceutical Assessment		Examination of drug administration, drug interactions, compliance, and drug side effects	Examination of drug administration, drug interactions, compliance, and drug side effects	Examination of drug administration, drug interactions, compliance, and drug side effects
Rehabilitation		Bed rest	Out of bed to a chair. Therapeutic exercise including ROM, Strengthening, ADL training	Therapeutic exercise, ADL training, mobilization with assistive device
Consultation and Education	Preoperative education	Education after surgery and post-operative care.	Education for Rehabilitation Education for wound dressing Education for foley catheter and drainage removal	Education for patients discharge, post-discharge plan including wound care and rehabilitation protocol
Discharge Plan				Patients are planned for discharge on the 3rd day after surgery if there are no complications.

Abbreviations: BMI, Body mass index; RT-PCR, Reverse transcription polymerase chain reaction

Table 2. Frequency Distribution of Research Sample Characteristics

No	Sample Characteristics	Amount		Total
		N	%	
1	**Age**			
	26 to 35 years	6	8	75
	36 to 45 years	4	5.3	
	46 to 55 years	8	10.7	
	56 to 65 years	24	32	
	66 to 75 years	24	32	
	76 to 85 years	9	12	
2	**Gender**			
	Male	21	28	75
	Female	54	72	
3	**Length of Stay (LoS)**			
	1 to 4 days	29	38.7	75
	5 to 10 days	37	49.3	
	11 to 20 days	8	10.7	
	21 to 30 days	1	1.3	
4	**Type of Surgical Procedure**			
	Bipolar Hemiarthroplasty	17	22.7	75
	Total Hip Arthroplasty	29	38.7	
	Total Knee Arthroplasty	29	38.7	
5	**Patient Outcome Status**			
	Recovered with LoS < 5 days	29	38.7	75
	Recovered with LoS ≥ 5 days	46	61.3	

Table 3. Frequency Distribution of Compliance Levels with Various Indicators

Indicator Clinical pathway	Compliance	Amount N	%	Total
Medical Assessment and Monitoring	Yes	29	38.7	75
	No	46	61.3	
Diagnostic Test	Yes	75	100	75
	No	0	0	
Medical treatment	Yes	54	72	75
	No	21	28	
Medication	Yes	75	100	75
	No	0	0	
Pharmaceutical Assessment	Yes	75	100	75
	No	0	0	
Rehabilitation	Yes	75	100	75
	No	0	0	
Consultation and Communication	Yes	75	100	75
	No	0	0	
Discharge Plan	Yes	46	61.3	75
	No	29	38.7	

Table 4. Frequency Distribution of Compliance Levels on Clinical Pathway of Arthroplasty

Clinical Pathway	Comply	Not Comply
Arthroplasty	29 (38.7 %)	46 (61.3%)

Table 5. Compliance of Clinical Pathway to Cost of Patient Services

Medical Cost (in Rupiah)	Compliance Level	Amount N	%
< 40 million	Yes	29	38.7
	No	25	33.3
≥ 40 million	Yes	0	0
	No	21	30

Implications for Policy and Practice

- Healthcare policymakers should mandate adherence to clinical pathway (CP) in arthroplasty cases to ensure consistent, high-quality care, reduce variability, and improve patient outcomes. Integrating CP into national healthcare regulations can promote best practices and ensure uniform treatment protocols.
- Strengthening CP compliance can optimize resource allocation, align insurance financial capacity with actual treatment costs, and enhance economic sustainability in public health systems. Hospitals should incorporate CP adherence into financial planning to maintain cost-effectiveness without compromising quality.
- Regular audits and training programs should be implemented to assess CP adherence, address compliance gaps, and enhance provider knowledge, ensuring ongoing improvements in clinical practice and patient care quality.

Discussion

Clinical pathway of arthroplasty

A thorough history and physical exam were performed for patients with knee or hip pain, including BMI measurement, knee inspection, palpation, gait analysis, and range of motion (ROM) assessment. Knee X-rays confirmed the diagnosis, grading and also guided treatment decisions.

Arthroplasty was indicated for severe cases with deformities or non-responsiveness to conservative therapy. Patients underwent preoperative assessment and were given education regarding the procedure and complications. Postoperatively, X-rays were taken, and monitoring focused on wound care, infection, pain, and mobility. Treatment included IV fluids, analgesics, antibiotics, and gastroprotective agents.

Daily evaluations included pain scale, ROM, wound care, and drain status. The Foley catheter was removed on POD-2, and the drain was removed when output was <30 cc/24 hours. The patient was discharged on POD-3, with a follow-up on day seven for wound review and suture removal. Table 2 outlines the arthroplasty clinical pathway.

Overview of compliance level of clinical pathway implementation in arthroplasty cases at secondary referral hospital

The assessment indicators were set based on the Guidelines for Clinical Practice Guidelines and Integrated Care pathways from the 2012 Indonesia Hospital Accreditation Standards. The evaluation checks if medical actions match the clinical pathway standards by comparing the actions of physicians, nurses, labs, and patients. An analysis then identifies which groups comply with the pathway and which do not.

Medical assessment and monitoring indicators

The initial stage in a clinical pathway is the evaluation of patients after they are admitted to the hospital. This process helps understand the patient's condition, assess health status, and identify special needs for personalized treatment. It is crucial for establishing an initial diagnosis and preparing medical treatment.

In this study, 61.3% of actions followed clinical pathway standards, while 38.7% did not. Non-compliance reasons include surgery preparation, post-operative care, drug administration, monitoring therapy, and assessing outcomes before patient discharge. A study by Sihotang et al. (2024) noted that lack of supervision and evaluation is a barrier to implementing clinical pathways, influenced by communication, resources, disposition, bureaucracy, and objectives.[11]

Diagnostic test indicators

Diagnostic tests in clinical pathways are a series of evaluations conducted to help diagnose, treat, and monitor a patient's condition, following a standard treatment plan. Their main goal is to ensure that medical procedures adhere to clinical standards, which aids recovery and minimizes differences in clinical practices. David L. Sackett (1996) emphasizes the importance of using scientific evidence, including diagnostic tests, in clinical pathways. Investigations are typically scheduled at specific treatment stages for reliable results. For instance, blood tests before surgery and post-operative imaging are conducted to confirm prosthesis placement in arthroplasty. This study indicates a 100% compliance rate with diagnostic test standards in the management of arthroplasty at a secondary referral hospital, which suggests that actions taken in case management arthroplasty have been carried out following the diagnostic test standards stipulated in the clinical pathway of Arthroplasty in our hospital. Additionally, Bairstow et al. (2005) point out that evidence-based clinical pathways improve the diagnostic process by reducing unnecessary tests and enhancing efficiency in diagnostic imaging practices.[12]

Medical procedures

Medical procedures in clinical pathways involve planned clinical interventions that follow established standards to treat specific patient conditions. These procedures may include surgery, medication, physical therapy, and continuous patient monitoring. Each procedure is organized according to a protocol detailing the timing, type of intervention, and its purpose. For instance, in arthroplasty management, the clinical pathway may consist of giving antibiotics before surgery to prevent infection, using specific anesthesia methods to reduce pain, and performing physical therapy after surgery to regain joint function.

This study found a 72% compliance rate, showing most actions followed the established protocols, while 28% showed non-compliance. This deviation warrants further evaluation to identify underlying causes and formulate corrective strategies to improve care quality in arthroplasty procedures.

Patients with arthroplasty surgery require optimal conditions to ensure the best possible outcomes. Those with comorbidities, psychological disorders, and low hemoglobin (Hb) levels necessitate further management until they are stable and in optimal condition. In this context, orthopaedics will consult with colleagues to enhance the patient's condition before surgery. Similarly, after the completion of arthroplasty, patients with comorbidities and psychological disorders, such as anxiety, may experience affected recovery, necessitating further intervention and extended care. Additionally, patients with mobility issues due to poor physical condition will require a longer duration for rehabilitation exercises following surgery. Lawal et al. (2016) noted that staff training, resource availability, and technological support issues often lead to deviations from the ideal clinical pathway. They suggested evaluating causes of non-compliance and implementing training, consistent resources, digital decision support systems, and regular audits to enhance adherence to protocols.[13,14]

Medication indicator

Medication in a clinical pathway involves using drugs based on evidence-based guidelines to treat health conditions. It aims to improve treatment results and ensure drug administration meets clinical standards. The "Pharmaceutical Care" theory, introduced by Hepler and Strand in 1990, highlights the responsibility of managing drug therapy for better health outcomes. This study's clinical pathway for medication indicators meets 100% of the set standards.

Pharmaceutical assessment indicator

Pharmaceutical assessment in clinical pathways evaluates a patient's drug needs, therapy effectiveness, and drug use risks. Its purpose is to ensure the medication aligns with the patient's health condition and

established standards. This assessment aids in creating standard therapy plans, improving drug use, preventing harmful interactions, and tracking patient treatment responses.

This study's clinical pathway implementation for pharmaceutical assessment indicators fully meets the standards (100% compliance). Based on research conducted by Sihotang et al. (2024), one of the obstacles to implementing clinical pathways in the pharmaceutical area is the supply of medicines according to clinical pathway guidelines. While the hospital provides drugs and consumables following clinical pathway regulations, the procurement process often takes a long time. This issue frequently arises, especially when drug therapy specified in the clinical pathway needs to be substituted with another medication.[11]

Rehabilitation and mobilization indicator

Rehabilitation and mobilization in the clinical pathway is a structured recovery process aimed at helping patients regain their optimal function after treatment. It includes physiotherapy, physical exercise, and occupational therapy to enhance strength, flexibility, and function. Rehabilitation is systematically planned based on the patient's condition and type of intervention, with early mobilization often starting within 24 hours post-surgery, particularly in arthroplasty cases.

The result of 100% compliance in this study illustrates that the clinical pathway implementation rate for rehabilitation and mobilization indicators fully meets clinical pathway standards. According to Guidelines for Perioperative Care in Total Hip and Knee Arthroplasty: Enhanced Recovery After Surgery (ERAS) Society Recommendations (Bairstow et al., 2005), early mobilization and rehabilitation are essential components in post-arthroplasty recovery that have been shown to improve functional outcomes and speed healing. However, this study also suggests that factors such as postoperative pain, age, comorbidities, and resource limitations may influence compliance with mobilization protocols, meaning that these recommendations should be adapted based on the patient's condition.[12]

Consultation and communication indicator

Consultation and communication in the clinical pathway involve healthcare professionals working together to improve patient care, share crucial medical information, and inform clinical decisions. This indicator includes discussions among doctors, nurses, pharmacists, and physiotherapists to assess a patient's condition and plan treatment. Effective communication ensures patients and families receive clear information about diagnoses, treatment plans, risks, and outcomes.

In this study, the patient care arthroplasty at Secondary Referral Hospital, the clinical pathway implementation for consultation and communication indicators have met the clinical pathway standard of 100%. Based on the results of research studies, doctors have collaborated between professions in preparation for surgery and post-operation regarding the patient's condition following the application of the clinical pathway. This result is supported by research conducted by Sihotang et al. (2024), which found that factors influencing the implementation of clinical pathway policies are communication factors, resources, disposition, bureaucratic structure, and dimensions and objectives.[12]

Discharge plan indicator

Discharge planning in a clinical pathway is a method to prepare patients for leaving the hospital or nursing facility after their acute care. The goal is to ensure patients recover safely at home or elsewhere while preventing complications. This planning includes assessing the patient's condition, educating them about follow-up care, arranging medical follow-ups, and coordinating with health workers. The plan is tailored to the patient's clinical state and recovery level. In the case of arthroplasty, discharge plans may include referrals for ongoing physical therapy, home pain management, and infection prevention measures.

The 61.3% compliance In this study indicates that in arthroplasty patient care at the hospital, implementing clinical pathways for discharge plan indicators does not fully meet the standard.

Overall, the presence of comorbid conditions, such as uncontrolled diabetes mellitus and hypertension, along with psychological disorders like anxiety and dementia, can increase the risk of postoperative complications. These complications may include infections, complex surgical wounds, heart disease, and anxiety during physical rehabilitation. Consequently, these factors can delay or hinder the discharge planning process.

A study conducted by Wiryawan et al. (2022) at a Semarang hospital found that the discharge plan implementation had not achieved the expected target. Additionally, several other factors, such as time management for doctor visits, the application of outpatient criteria, understanding of local regulations regarding the administration process one day before the patient discharge, communication among medical personnel from various disciplines, and the patient's social and cultural beliefs regarding the day of discharge, also influence the discharge process.[18]

Frequency Distribution of Compliance Levels of All Parameters on Clinical Pathway of Arthroplasty

Research conducted by Artriawan et al. (2020) shows that the level of compliance with the implementation of CP contributes positively to the clinical quality of patients. Properly followed CP can direct medical practice based on scientific evidence, ensuring that every step in patient care is followed according to established standards. This result is also supported by Fadilah and Budi (2018) in a study that stated that patient compliance would impact better clinical outcomes, such as reducing the length of treatment and improving the patient's quality of life.[19] In our study, the level of compliance at the rate of 38.7 %. This result was due to several parameters, including medical assessment and monitoring, medical procedures, and discharge planning, reveal discrepancies in the implementation of the clinical pathway (CP). Contributing factors to these discrepancies include surgical preparation, the patient's condition with comorbidities and psychological disorders, postoperative care, and the assessment of patient outcomes before discharge.

Compliance of Clinical Pathway to Cost of Patient Services

Cost of patient services refers to all costs incurred during patient service, including accommodation, medical personnel, medications, equipment, administration, and other operational expenses. This research focused on costs in arthroplasty by examining accommodation, laboratory, radiology, drugs, consumables, implant costs, and service charges from billing records data. Costs are based on valid proof of expenditure.[20]

Table 5 categorizes costs into less than or more than 40 million rupiah. Among the 54 patients with costs below 40 million rupiah, 29 complied with the clinical pathway, while 25 did not. All 21 patients with costs over 40 million were patients who did not comply with CP. The chi-square test showed a significant relationship between clinical pathway compliance and patient service costs, indicating that compliance with CP resulted in lower overall service costs. Non-compliance may lead to additional treatments and increased costs, supported by similar findings from Haninditya et al. (2019).[21]

Conclusion

This study examined clinical pathways for arthroplasty patients at a secondary referral hospital, focusing on patient distribution, compliance with procedures, treatment outcomes, and its impact on service costs. Most patients were in treatment with a length of stay (LoS) of 5-10 days. Types of surgeries included total hip and knee arthroplasties and bipolar hemiarthroplasty. Compliance varied, with some indicators fully met, while others showed significant non-compliance due to patient conditions—adherence linked to shorter LoS and better outcomes, impacting overall service cost. Non-compliance increased costs, suggesting the need for improved adherence to clinical pathways.

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GLOSSARY

Clinical Pathway (CP): A standardized, evidence-based multidisciplinary plan outlining essential steps in the care of patients with a specific clinical problem.

INA-CBGs: Indonesia Case Based Groups – the payment system under BPJS (Indonesia's National Health Insurance) for inpatient services.