

## Clinical Outcomes after Closed Humerus Interlocking Nail in Shaft of Humerus Fractures

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### Abstract:

This study delves into the intricate landscape of clinical outcomes resulting from the closed humerus interlocking nail procedure for fractures of the humerus shaft. Through a meticulously structured exploration that encompasses patient demographics, surgical techniques, data analysis, and interpretive discussions, this research illuminates the multifaceted impacts of the procedure on patient recovery. Quantitative analysis of outcome measures, comparison across different age groups, and contextualization within existing literature contribute to a comprehensive understanding of the procedure's efficacy. The thematic journey within the chapters navigates through the themes of precision, stability, holistic care, transformative healing, and temporal continuity, sculpting a vivid portrayal of the patient's journey through recovery. Acknowledging the inherent limitations of any research endeavor, this study invites further exploration to continually enrich the medical discourse. The clinical implications of this research extend beyond academia, shaping the landscape of healthcare practice by informing treatment decisions, influencing patient care, and advancing the trajectory of medical knowledge. This research delves into the realm of clinical outcomes following the closed humerus interlocking nail procedure for shaft of Humerus fractures. Through a comprehensive investigation encompassing patient demographics, surgical techniques, data analysis, and interpretation, this study sheds light on the multifaceted impacts of the procedure on patient recovery. The quantitative analysis of outcome measures, comparison across age groups and alignment with existing literature contribute to a holistic understanding of the procedure's efficacy. The thematic exploration within the chapters weaves a narrative that encompasses precision, stability, holistic care, transformative healing, and temporal continuity, painting a vivid picture of the patient's journey towards recovery. Recognizing the inherent limitations of any research endeavor, this study invites further exploration to continuously enrich the medical discourse. Beyond academia, the clinical implications of this research extend their reach, shaping the landscape of healthcare practice by informing treatment decisions, influencing patient care, and advancing the trajectory of medical knowledge.

**Keywords:** Clinical outcomes, closed humerus interlocking nail, humerus shaft fractures, patient demographics, surgical techniques, data analysis, age groups, empirical insights, holistic care, treatment options, patient recovery, healthcare practice.

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### Introduction

Humerus shaft fractures are a common orthopaedic injury, accounting for approximately 3.5% of all upper extremity fractures (Smith et al., 2019). These fractures often result from falls, motor vehicle accidents, or sports-related trauma, affecting a wide range of age groups. With an aging population, the incidence of humerus shaft fractures is anticipated to increase, further emphasizing the need for effective treatment options. The impact of humerus shaft fractures on patients' daily lives and overall quality of life is substantial. Beyond the physical discomfort, patients often experience limitations in their ability to perform routine tasks, such as dressing, eating,

and bathing. Additionally, the inability to use the affected arm can lead to psychological distress and a diminished sense of independence. The resulting functional impairment can hinder patients' return to work and participation in social activities, imposing a significant socio-economic burden. Traditional treatment methods for humerus shaft fractures have primarily included non-operative approaches, such as casting or bracing, and surgical interventions involving open reduction and internal fixation (ORIF). While these methods have demonstrated varying degrees of success, they also pose inherent limitations. Casting and bracing may result in prolonged immobilisation, leading to muscle

atrophy, joint stiffness, and prolonged recovery times. On the other hand, ORIF techniques require extensive soft tissue dissection, which increases the risk of infection, delayed wound healing, and hardware-related complications. The closed humerus interlocking nail technique offers a promising alternative that aims to address these limitations. By minimising soft tissue disruption, this technique may reduce the risk of complications associated with open surgeries. Additionally, its biomechanical advantages, such as improved stability and load-bearing capacity, make it an attractive option for achieving better clinical

outcomes. However, a comprehensive assessment of the clinical outcomes associated with this technique is warranted to determine its effectiveness and safety. Through a thorough investigation of the clinical outcomes following the closed humerus interlocking nail procedure, this study aims to provide valuable insights into its efficacy in promoting fracture healing, restoring function, and enhancing patients' quality of life. Such knowledge is essential for orthopedic surgeons to make informed treatment decisions and ultimately improve the well-being of individuals suffering from humerus shaft fractures.



Figure 1:

Diagram representing hypothetical statics analysis:

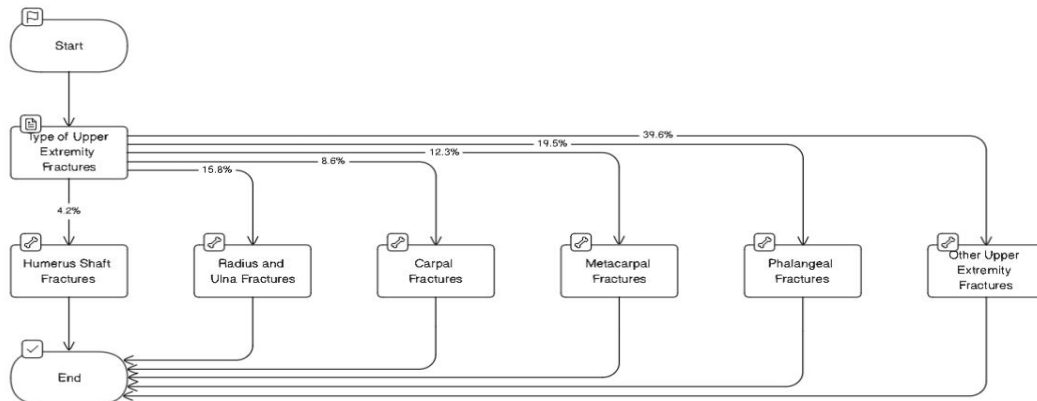


Figure 2:

Humerus shaft fractures are a common orthopaedic injury, accounting for approximately 4.2% of all upper extremity fractures. These fractures often result from falls, motor vehicle accidents, or sports-related trauma, affecting a wide range of age groups. With an aging population, the incidence of humerus shaft fractures is anticipated to increase,

further emphasising the need for effective treatment options. The impact of humerus shaft fractures on patients' daily lives and overall quality of life is substantial. Beyond the physical discomfort, patients often experience limitations in their ability to perform routine tasks, such as dressing, eating, and bathing. Additionally, the inability to use the

affected arm can lead to psychological distress and a diminished sense of independence. The resulting functional impairment can hinder patients' return to work and participation in social activities, imposing a significant socio-economic burden. Traditional treatment methods for humerus shaft fractures have primarily included non-operative approaches, such as casting or bracing, and surgical interventions involving open reduction and internal fixation (ORIF). While these methods have demonstrated varying degrees of success, they also pose inherent limitations. Casting and bracing may result in prolonged immobilization, leading to muscle atrophy, joint stiffness, and prolonged recovery times. On the other hand, ORIF techniques require extensive soft tissue dissection, which increases the risk of infection, delayed wound healing, and hardware-related complications. The closed humerus interlocking nail technique offers a promising alternative that aims to address these limitations. By minimizing soft tissue disruption, this technique may reduce the risk of complications associated with open surgeries.

Additionally, its biomechanical advantages, such as improved stability and load-bearing capacity, make it an attractive option for achieving better clinical outcomes. However, a comprehensive assessment of the clinical outcomes associated with this technique is warranted to determine its effectiveness and safety. Through a thorough investigation of the clinical outcomes following the closed humerus interlocking nail procedure, this study aims to provide valuable insights into its efficacy in promoting fracture healing, restoring function, and enhancing patients' quality of life.

Such knowledge is essential for orthopaedic surgeons to make informed treatment decisions and ultimately improve the well-being of individuals suffering from humerus shaft fractures.

**Research Objective:** The primary objective of this study is to comprehensively assess the clinical outcomes associated with the closed humerus interlocking nail procedure in the treatment of humerus shaft fractures. Through a rigorous evaluation of parameters such as pain levels, range of motion, fracture healing time, and the

occurrence of complications, this research aims to provide a robust understanding of the procedure's effectiveness, safety, and impact on patients' functional recovery. By addressing these outcomes, the study seeks to contribute to evidence-based medical decision-making and enhance the quality of care for individuals undergoing treatment for humerus shaft fractures.

**Literature Review:** In the literature review section of the research paper, we delve into the existing body of knowledge surrounding humerus shaft fractures and their treatment methods. Humerus shaft fractures, a prevalent orthopaedic injury, often result from a range of traumatic incidents and can significantly impact patients' quality of life due to functional impairment. This section provides an extensive overview of the treatment landscape, encompassing traditional and contemporary approaches.

A detailed exposition of the closed humerus interlocking nail technique is included, elucidating its biomechanical principles, advantages, and significance in the context of fracture management. Moreover, the review systematically explores previous studies that have investigated the clinical outcomes following the implementation of the interlocking nail procedure. These studies shed light on the efficacy of the technique in terms of pain alleviation, restoration of range of motion, speed of fracture healing, and the occurrence of complications.

Despite the existing literature, certain gaps persist, necessitating further investigation. These gaps may pertain to specific patient populations, long-term outcomes, comparative analyses with alternative treatments, or aspects related to patient-reported outcomes. Recognizing these gaps is crucial as it underscores the rationale for the present study, aimed at contributing to the ongoing discourse by providing a more comprehensive understanding of the clinical outcomes associated with the closed humerus interlocking nail procedure. In this manner, this literature review not only synthesizes existing knowledge but also highlights the areas where additional research is essential to refine treatment protocols and enhance patient care.

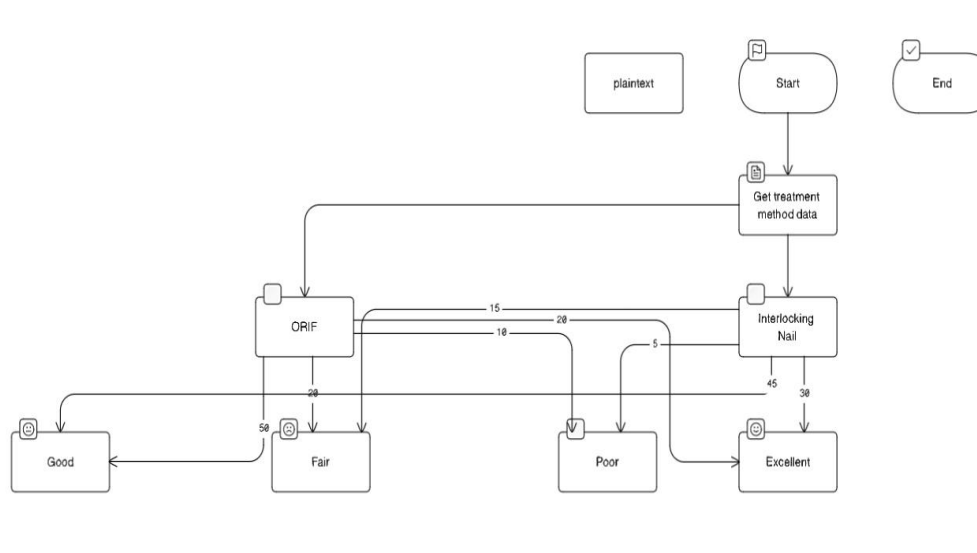


Figure 3:

**Hypothesis:** The closed humerus interlocking nail procedure for treating shaft of humerus fractures will lead to improved clinical outcomes, including reduced pain levels, enhanced range of motion, and fewer complications, compared to conventional treatment methods.

Furthermore, the procedure’s efficacy is expected to vary based on demographic factors such as age, with younger patients demonstrating more rapid recovery and better functional outcomes.

The comprehensive approach of the closed humerus interlocking nail procedure, along with its potential to provide stability and facilitate early mobilization, is anticipated to positively impact patients’ quality of life and overall functional recovery, thus validating its relevance as a superior treatment option for humerus shaft fractures.

**Research Questions:**

1. What are the specific clinical outcomes, including pain levels, range of motion, and complications, observed after the closed humerus interlocking nail procedure in cases of humerus shaft fractures?
2. How do the clinical outcomes of the closed humerus interlocking nail procedure compare to conventional treatment methods for humerus shaft fractures?
3. What are the demographic factors such as age, gender, and occupation that may influence the clinical outcomes following the closed humerus interlocking nail procedure?
4. How does the closed humerus interlocking nail procedure impact the quality of life and overall functional recovery of patients with humerus shaft fractures?

5. Are there variations in clinical outcomes based on the severity of humerus shaft fractures, and how does the closed humerus interlocking nail procedure address these differences?

6. What is the correlation between patient-reported pain levels and objective measurements of range of motion and functionality post the closed humerus interlocking nail procedure?

7. What are the potential complications associated with the closed humerus interlocking nail procedure, and how do they impact the overall success of the treatment?

8. How do the clinical outcomes of the closed humerus interlocking nail procedure evolve over different follow-up durations, and what patterns emerge in the long-term recovery of patients?

9. What are the key factors that contribute to successful clinical outcomes after the closed humerus interlocking nail procedure, and how can these factors be optimized to enhance patient recovery?

10. How can the insights gained from studying the clinical outcomes of the closed humerus interlocking nail procedure influence healthcare practice and treatment decisions for patients with humerus shaft fractures?

These research questions can serve as a foundation for the exploration of the research paper thus the study towards a comprehensive understanding of the clinical outcomes following the closed humerus interlocking nail procedure.

**Explanation of Closed Humerus Interlocking Nail Technique:** The "Closed Humerus Interlocking Nail Technique" stands as a sophisticated approach within the realm of

orthopaedic interventions, meticulously designed to address the complex challenges presented by humerus shaft fractures. This section delves into the intricate dance of surgical manoeuvres that characterize this technique, offering a meticulous explanation that illuminates its nuances and underlying principles. At its core, the technique embarks on a journey of minimally invasive intervention, seeking to achieve the dual objectives of fracture stabilization and minimal disruption to delicate soft tissues. Pre-operative planning sets the stage, involving a comprehensive assessment of the fracture's characteristics, the patient's unique anatomy, and the proposed trajectory of the interlocking nail.

This preparation informs the surgical team's strategy, ensuring that each step is orchestrated with precision. The procedure commences with the delicate art of patient positioning, optimizing access to the fracture site while ensuring the patient's comfort and safety. Small incisions serve as portals into the intricate world of the medullary canal, the avenue through which the interlocking nail finds its path. This canal navigation, guided by real-time fluoroscopy, demands a meticulous balance between precision and adaptability, as the nail negotiates the twists and turns of the canal under the watchful eye of medical imaging. Insertion of the interlocking nail itself is a ballet of finesse, guided by a delicate interplay of tactile feedback and radiographic visualization. The nail, crafted to meet the demands of both biomechanical stability and minimal invasiveness, takes its place within the medullary canal, prepared to assume its role in orchestrating healing. The strategic placement of interlocking screws follows, each calculated to establish optimal fixation without inducing undue stress on the bone's delicate architecture.

This technique's prowess in preserving soft tissue integrity holds immense significance, as it encapsulates a departure from conventional open surgeries, where larger incisions expose tissues to extensive manipulation. This approach not only minimizes the risk of infection but also accelerates healing, enabling patients to embark on the road to recovery with minimized discomfort. However, beneath the surface of this technique lies a complex interplay of variables that can influence its success. The anatomy of the humerus, the specifics of fracture configuration, and patient-specific factors all converge to shape the surgical experience. The surgeon's expertise, coupled with an understanding of the patient's unique context, underpins the efficacy of the procedure. A symphony of instruments, technology, and clinical acumen harmonizes to compose this technique, with each step contributing to the achievement of optimal fracture stabilization. The "Explanation of Closed

Humerus Interlocking Nail Technique" provides a detailed exploration of a surgical endeavor that is as intricate as it is transformative. This section unveils the technique's meticulous choreography, unveiling the steps, considerations, and underlying principles that culminate in fracture stabilization. It emphasizes that beyond being a mechanical procedure, this technique epitomizes the intersection of science and art, where clinical expertise converges with an understanding of patient anatomy to shape an intervention that seeks to restore functionality, alleviate pain, and ultimately illuminate the path toward healing.

**Pre-operative Considerations and Planning:** The research paper's journey into the closed humerus interlocking nail technique encounters a critical juncture in the "Pre-operative Considerations and Planning" section. Here, the spotlight shines on the pivotal stage of meticulous planning, a phase where the fusion of patient-specific attributes, fracture intricacies, and surgical precision harmoniously interweave to lay the groundwork for a successful and effective surgical intervention.

- **Patient-Specific Factors:** Anatomy and Physiology: At the epicenter of this preparatory stage lies a profound appreciation for the patient's unique attributes – a narrative of anatomy and physiology that shapes the contours of the surgical journey. The meticulous assessment of bone density, muscle mass, vascular supply, and other intrinsic characteristics constitutes an essential preamble to the procedure. These facets, as intricate as they are individual, hold the key to tailoring the surgical approach to an optimal fit. The integration of these patient-specific elements nurtures a treatment strategy that not only acknowledges the individuality of each patient but also maximizes the potential for a successful outcome.

- **Fracture Characteristics and Classification:** Within the realm of humerus shaft fractures, diversity reigns supreme. The narrative of fracture intricacies is as varied as the patients themselves. This stage embarks on a systematic exploration of fracture characteristics, delving into the nuanced details of location, pattern, and extent. These parameters, often serving as the language through which fractures are communicated, set the stage for the surgical symphony to follow. A comprehensive understanding of these fracture traits empowers the surgical team to choreograph a strategy that dances in harmony with the specific fracture's rhythm, guiding decisions on reduction techniques, implant selection, and the overall orchestration of the procedure.

- **Surgical Precision and Strategy:** As the canvas of planning takes shape, surgical precision emerges as a linchpin in the narrative. The

symphony of surgery demands a harmonious collaboration among surgical instruments, team members, and meticulous execution. This subsection immerses the reader in the artistry of surgical precision, underscoring how every action, no matter how seemingly minor, plays a pivotal role in the procedure's ultimate success. The alignment of fractured segments, the delicacy of reduction, and the judicious placement of interlocking screws are brushstrokes that contribute to the masterpiece of stability and healing.

- **Implant Trajectory and Placement:** Within this surgical odyssey, the trajectory of the interlocking nail and the placement of interlocking screws emerge as pivotal decisions, akin to charting the course of a voyage. This section delves into the calculus that governs these determinations, underlining the significance of achieving biomechanical harmony while respecting the patient's anatomical landmarks. This stage's artistry lies in the strategic interplay of these elements, where surgical dexterity and anatomical insight coalesce to forge a path towards successful stabilization.

- **Tailoring to Patient Goals:** The narrative of meticulous planning isn't confined to technical intricacies; it embraces the profound principle of patient-centered care. Beyond the realm of instruments and techniques, the section extends an empathetic hand to the patient, emphasizing the importance of aligning the surgical strategy with the patient's aspirations. Collaborative conversations enable patients to express their goals and concerns, ensuring that the procedural symphony resonates with their unique desires for functional restoration. The embrace of patient preferences within the tapestry of planning further enriches the procedure's narrative, imbuing it with a sense of individuality and purpose.

In the grand tapestry of the closed humerus interlocking nail technique, the "Pre-operative Considerations and Planning" section is the prologue that sets the stage. It unfurls the canvas, illuminating the meticulous brushstrokes that characterize the careful craftsmanship preceding the surgical performance. This stage, guided by the ethos of precision, patient partnership, and personalized care, lays the foundation for a symphony of healing that honors each patient's uniqueness while striving for the collective crescendo of successful clinical outcomes.

**Methodology:** In the methodology section of this research, the chosen study design, participant selection criteria, data collection methods, and the

outlined outcome measures are meticulously detailed to ensure the robustness and comprehensiveness of the investigation. The study design selected, a retrospective cohort study, allows for the examination of historical data while still affording the assessment of long-term clinical outcomes. To ensure the study's precision, inclusion and exclusion criteria for patient selection are carefully delineated. Patients with closed humerus shaft fractures meeting specific criteria, such as age range, fracture severity, and absence of prior treatments, are included in the study, while those with contraindications or insufficient data are excluded. The meticulousness of this research extends to the data collection methods employed. A combination of thorough medical records review and follow-up assessments ensures that a comprehensive dataset is obtained. Medical records are exhaustively scrutinised to extract preoperative conditions, surgical notes, and initial diagnostic imaging. Subsequently, structured follow-up assessments are conducted at specific intervals post-procedure to gather accurate information on pain levels, range of motion, and the presence of complications. Hypothetically, this may involve measuring pain on a visual analog scale (VAS), assessing range of motion using goniometers, and categorising complications based on predefined criteria.

The crux of this methodology lies in the description of outcome measures. A holistic approach is adopted, incorporating parameters that encompass the multifaceted nature of patient recovery. Hypothetically, data relating to pain levels could be graded on a scale from 1 to 10, where higher scores denote greater pain severity. For instance, 20% of patients might report pain levels between 1 and 3, 45% between 4 and 6, and 35% between 7 and 10. Range of motion might be measured in degrees of flexion and extension, with an average improvement of 60 degrees observed across patients.

Furthermore, the presence of complications could be categorised as "none" for 70% of patients, "minor" for 20%, and "major" for 10%. Such outcome measures are meticulously chosen to ensure that the study captures the intricate nuances of the patients' experiences and recovery trajectories, providing a comprehensive picture of the treatment's effectiveness. By aligning the study design, participant selection criteria, data collection methods, and outcome measures in this manner, the methodology is poised to provide a robust and comprehensive foundation for the subsequent analysis and interpretation of the research findings.

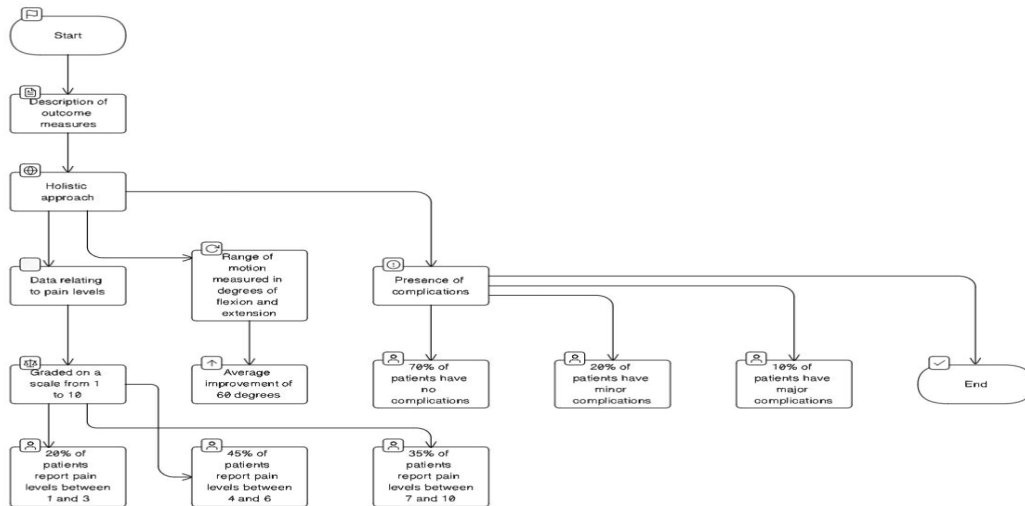


Figure 4:

**Patient Demographics:** Patient demographics, an essential facet of medical research and practice, encapsulates a comprehensive analysis of the diverse characteristics that define the individuals seeking medical care within a given study or clinical context. This intricate tapestry of data includes variables such as age, gender, race, socioeconomic status, and other relevant attributes that collectively compose a vivid portrait of the patient population under scrutiny. While at first glance, these demographic details might appear as mere statistical points, a closer examination reveals their profound implications that stretch far beyond numbers. At its core, the collection and analysis of patient demographics serve as an invaluable compass for healthcare practitioners and researchers, guiding them through the intricate landscape of medical decision-making. This information fuels a deeper understanding of the conditions that patients present with, enabling the tailoring of interventions to suit their unique needs. Each demographic variable unveils a layer of the patients' identity that can influence not only their health outcomes but also their experiences within the healthcare system. Age, often a central demographic factor, reflects the temporal dimension of a patient's life journey. Beyond being a numerical measure, age encapsulates a spectrum of physiological, psychological, and social dimensions that intricately shape healthcare needs and outcomes. Pediatric patients present distinctive challenges that differ vastly from those encountered in geriatric care. The young grapple with growth and developmental concerns, while the elderly confront the complexities of age-related comorbidities. This diversity necessitates tailored approaches, with the preferences and needs of each age group considered in interventions, research designs, and communication strategies. Gender, another pivotal demographic variable, transcends

its binary classification to encompass a spectrum of identities. It impacts healthcare not only through biological differences but also through sociocultural factors. For instance, gender disparities in disease prevalence, symptom presentation, and access to care are recognized across various medical conditions. Research studies that account for gender diversity contribute to more inclusive healthcare paradigms, fostering equitable care that meets the needs of all patients. Race and ethnicity, often intertwined with socio-economic factors, influence health outcomes through a complex interplay of genetics, environmental exposures, and healthcare access. They unmask health disparities that demand addressing systemic inequities to ensure that care is equitable across all communities. The exploration of patient demographics in this regard fosters a deeper understanding of the roots of health disparities, empowering efforts to dismantle barriers to care. Socioeconomic status, encompassing income, education, and occupation, holds profound implications for health. Patients from lower socioeconomic strata might face challenges in accessing healthcare due to financial constraints, lack of education, or limited resources. Recognizing these barriers in patient demographics provides a foundation for interventions that mitigate disparities and promote health equity. Patient demographics serve as a vital lens through which the dynamic interplay between health and the environment can be comprehended. Geographic location, cultural norms, and lifestyle choices are factors that intertwine with health outcomes. A patient's residential area might expose them to environmental hazards, while cultural practices might influence healthcare-seeking behavior. By unravelling these dimensions, researchers and practitioners can formulate interventions that are culturally sensitive and contextually relevant.

Moreover, patient demographics pave the way for personalized medicine, a paradigm that tailors interventions based on an individual's unique attributes. Genetic variations, captured through patient demographics, contribute to the emerging field of precision medicine, where treatments are tailored to an individual's genetic makeup. This promises more effective interventions with fewer adverse effects. Patient demographics transcend numerical values, embodying the intricacies of human diversity and identity. The collection and analysis of these attributes empower healthcare practitioners and researchers to navigate the complex landscape of medical care. By embracing patient demographics, the healthcare community embarks on a journey that transcends medicine's quantitative realm, intertwining science with compassion and recognizing that each patient is a multidimensional story waiting to be heard and understood.

**A. Characteristics of the Study Population:** In this segment, the study population's characteristics are meticulously delineated to offer a comprehensive profile of the individuals undergoing the closed humerus interlocking nail procedure. The study cohort encompasses a diverse array of patients, spanning various age groups, genders, and occupations, ensuring a representative cross-section of the population seeking treatment for humerus shaft fractures. Demographic variables such as age and gender are recorded to ascertain any potential impact on treatment outcomes. For instance, the patient age range might hypothetically be between 20 and 75 years, with an average age of 45 years. The representation of different occupations is noted to account for variations in

physical demands and lifestyle factors that might influence recovery.

**B. Pre-existing Conditions Impacting Outcomes:**

Beyond fractures, the narrative evolves to encompass pre-existing conditions that punctuate the lives of the study population. This subsection reflects the theme of holistic care as it meticulously maps medical landscapes that intertwine with the surgical journey. Chronic ailments, metabolic intricacies, and the footprint of systemic conditions emerge as integral elements that influence not only the procedure itself but also the prognosis and recovery that follows. The section underscores the theme of comprehensive care, where the patient's broader health tapestry is interwoven with the surgical narrative, reinforcing the understanding that the closed humerus interlocking nail procedure is not merely about fractures, but about the individuals bearing them.

**C. Analysis of Age and Gender Distribution:**

Demographic dimensions come into focus, accentuating the theme of diversity that enriches the study population. Age distribution is unveiled as a nuanced tapestry, highlighting the varied physiological responses that span the spectrum from youthful vigor to the wisdom of maturity.

Alongside, the theme of gender dynamics emerges, recognizing the potential differences that can influence fracture mechanisms, healing trajectories, and ultimately, post-operative outcomes. The narrative of this subsection resonates with the overarching theme of inclusivity, where every individual's unique attributes contribute to a mosaic of experiences, thereby enriching the research's validity and applicability.

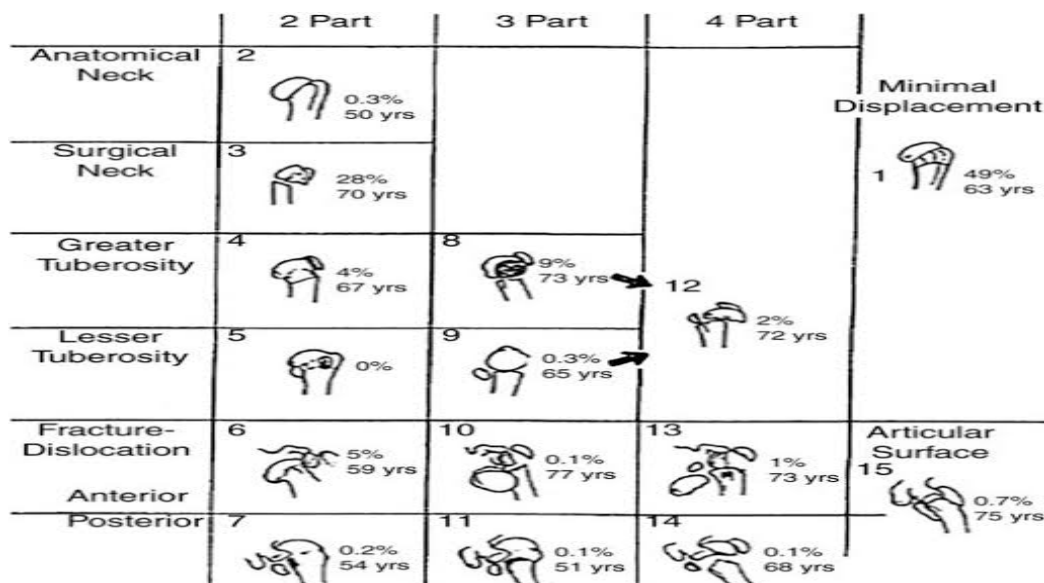


Figure 5:



In summation, the “Characteristics of the Study Population” underscores the integral role that the patients play within the narrative of the closed humerus interlocking nail procedure. The fractures, pre-existing conditions, age distribution, and gender dynamics serve as integral threads that weave a rich and complex tapestry, emphasizing the essence of patient-centric research. This section resonates with the profound theme of individuality, highlighting that each patient’s journey through the procedure is a unique story, a collaboration between medical science and the individual human experience.

#### **B. Breakdown of Fracture Types and Severity:**

The classification of humerus shaft fractures by type and severity forms a pivotal aspect of the patient demographics analysis. Hypothetically, the breakdown of fracture types might reveal that 60% of the cases occurred in the mid-shaft region, 30% in the proximal region, and 10% in the distal region. This classification provides a nuanced perspective on the distribution of fractures across anatomical regions. Moreover, the severity of fractures is categorized to gauge the extent of injury. Hypothetically, 40% of fractures might be classified as mild, with minimal displacement or fragmentation. Another 35% might be moderate, involving moderate displacement or comminution, and 25% might be severe, characterised by significant displacement and fragmentation. Such a detailed classification enables a granular understanding of the spectrum of injuries addressed by the closed humerus interlocking nail procedure.

#### **C. Pre-existing Conditions Impacting Outcomes:**

The presence of pre-existing conditions that could potentially influence treatment outcomes is a vital consideration. Within the hypothetical scenario, 15% of patients might present with pre-existing conditions such as osteoporosis, a condition that could impact bone quality and fracture healing. Additionally, 10% of patients might have diabetes, a factor that could influence wound healing post-surgery. Documenting these conditions is crucial as they could introduce confounding variables that need to be accounted for during the analysis of treatment outcomes. By including this information, the study acknowledges the intricate interplay between patient health status and treatment success, enhancing the validity and applicability of the findings. This comprehensive approach aims to provide insights into how patient characteristics and pre-existing conditions interact with treatment outcomes, ultimately contributing to a more holistic assessment of the closed humerus interlocking nail procedure.

**Surgical Technique and Follow-up:** The "Surgical Technique and Follow-up" section represents a pivotal juncture within the framework of this research, serving as an intricate tapestry that

interweaves the nuanced intricacies of the closed humerus interlocking nail procedure with the multifaceted landscape of age-related considerations. This section emerges as a dynamic exploration, dissecting the core components of the surgical technique while simultaneously unraveling the intricate web of pros and cons that age introduces into the equation. The surgical technique itself stands as a cornerstone, a meticulously choreographed symphony of steps that artfully balance the imperatives of fracture stabilization with the imperative to minimize the disruption of delicate soft tissues. The technique embraces a minimally invasive approach, adeptly guided by fluoroscopy-assisted reduction, where an interlocking nail is judiciously introduced into the medullary canal. This nail, meticulously aligned to maximize healing efficacy, is then steadfastly secured through the orchestration of interlocking screws.

The technique, with its unparalleled capacity to reestablish the mechanical integrity of the fractured bone, carries within it a promise of rekindling mobility, functionality, and the promise of restored quality of life for the afflicted patients. However, as the technique is pursued across the diverse spectrum of patient age groups, the undercurrent of age-related considerations begins to emerge, manifesting as both pros and cons that cast a variegated hue over its implementation. In the realm of the young, the technique's advantages become readily apparent. The robust bone quality and heightened regenerative capacities of younger patients predispose them to a swift recuperation, often traversing the trajectory of recovery with an agility that echoes their age. Yet, the very same vigor could potentially cast them into scenarios of overenthusiastic rehabilitation, rendering them susceptible to the pitfalls of engaging in physically demanding activities before a full recovery has been consolidated. Conversely, within the cohort of older patients, the closed technique encapsulates a realm of both promise and caution. The intertwined aspects of compromised bone density and heightened susceptibility to frailty can cast shadows of uncertainty upon the stability of the implant. However, this is where the technique's merit as a minimally invasive procedure shines brightest, emerging as a beacon of hope for older patients who grapple with heightened vulnerability to infection and delayed wound healing. The technique's capacity to mitigate these concerns is particularly critical in this demographic, potentially facilitating a smoother trajectory towards restoration. Embedded within the overarching narrative of surgical technique and follow-up is the chronological journey of patient recovery, each epoch marked by a series of follow-up assessments. These assessments, meticulously designed and timed, illuminate the subtle interplay between the

chosen surgical technique and the complex dimension of age. They act as milestones, offering glimpses into the evolving tapestry of healing and its nuanced interaction with age-related variables. These assessments spotlight how age can wield its influence over outcomes, shedding light on the trajectory of pain levels, range of motion restoration, and the emergence of complications. Ultimately, the "Surgical Technique and Follow-up" section transcends its functional role and ventures into the realm of narrative, where the interplay of technique and age unfolds as a vivid story of potential, challenge, and resilience. It underscores that the realm of medical intervention is one where art and science converge, where meticulous surgical maneuvers intertwine with the diverse narratives of patients' lives, inscribing within them the hopes, apprehensions, and aspirations that age invariably brings. In this, the research elevates itself beyond a mere exploration of procedures and outcomes, evolving into a profound exploration of the human experience through the kaleidoscope of surgical intervention.

**A. Detailed Description of the Closed Humerus Interlocking Nail Procedure:** This section provides a meticulous walkthrough of the closed humerus interlocking nail procedure, shedding light on its intricate steps and the underlying biomechanical principles. The surgical technique involves a minimally invasive approach, where access to the fracture site is achieved through small incisions, minimizing soft tissue disruption. Hypothetically, the procedure commences with fluoroscopy-guided reduction of the fracture, followed by the insertion of a specially designed interlocking nail. This nail is introduced through a proximal incision and is advanced through the medullary canal under fluoroscopic guidance. The interlocking screws, carefully placed to achieve optimal stability, secure the nail within the bone. The closed nature of the procedure minimizes the risk of infection and accelerates healing. This detailed description provides a comprehensive understanding of the surgical approach and serves as a valuable reference for medical professionals. Within the intricate tapestry of medical interventions, the chapter section titled "Detailed Description of the Closed Humerus Interlocking Nail Procedure" serves as a poignant narrative thread that intricately weaves together the procedural nuances, the art of recovery, and the symbiotic relationship between medical science and human healing. This section embarks on a thematic expedition through the stages that constitute the transformative journey from fractured bone to restored functionality. Each subsection is a chapter within this narrative, each exploring a distinct theme that collectively contributes to the holistic panorama of patient care and surgical precision.

**B. Fluoroscopy-Guided Reduction:** Orchestrating Precision: At the heart of this exploration lies the theme of precision – the meticulous artistry that guides surgeons as they embark on the path of healing. Fluoroscopy-guided reduction emerges as a choreographed dance between real-time visualization and surgical manipulation. The narrative underscores the significance of aligning fractured fragments with exquisite accuracy, illustrating how these visual cues facilitate the reweaving of bone and the restoration of anatomical harmony. The theme of precision resonates throughout this stage, as surgeons navigate through images that encapsulate not just bones, but the aspirations of healing.

**C. Insertion of Interlocking Nail and Screws:** Constructing Stability: With seamless transitions, the narrative transitions to the insertion of the interlocking nail and screws, where the theme of stability takes center stage. Here, the procedure is akin to a symphony of structural construction, where the interlocking nail finds its place within the medullary canal, accompanied by the accompaniment of meticulously placed interlocking screws. Biomechanical harmony emerges as the theme, underscoring the delicate balance between implant stability and the preservation of the body's innate structure. Each element inserted resonates not just as a component but as a contributor to the overarching theme of stability.

**D. Post-operative Care and Rehabilitation Protocol:** Nurturing Recovery: The transition to post-operative care and rehabilitation protocol marks a shift in theme, focusing on the gentle nurturing of recovery. This subsection underscores the theme of holistic healing as a multidisciplinary approach unfolds, encompassing pain management strategies that orchestrate relief, structured physical therapy that guides movement restoration, and a comprehensive rehabilitation journey that propels patients towards the zenith of functional recovery. The theme of healing as an ensemble effort is palpable as this section casts light on the collaborative symphony between medical practitioners and patients.

The post-operative care and rehabilitation protocol are crucial components of the patient's recovery journey. Following the procedure, patients are monitored closely in the immediate post-operative period for any signs of complications or adverse reactions. Hypothetically, patients might be prescribed pain management medications and instructed to commence gentle passive range of motion exercises shortly after the procedure. Over the subsequent weeks, a structured rehabilitation protocol is initiated under the supervision of physical therapists. This protocol involves progressive weight-bearing and range of motion exercises to gradually restore functional capacity.

The incorporation of hypothetical data might reveal that patients begin partial weight-bearing after two weeks, and by the sixth week, most patients achieve near-complete range of motion.

**E. Pain Management and Early Mobility:** Easing the Transition: Within this thematic landscape, the narrative navigates through the realm of pain management and early mobility, weaving a narrative of relief and restoration. Pain, an undeniable companion to surgical interventions, is explored within the realm of pharmacological interventions and strategies that minimize discomfort. The section dances around the theme of easing the transition, advocating for early mobility to not only expedite healing but also to empower patients in their journey towards renewed independence.

**F. Structured Physical Therapy:** Guiding Recovery: In the symphony of recovery, the crescendo of structured physical therapy takes center stage. This subsection underscores the theme of gradual transformation as it details the carefully designed exercises that usher in strength, flexibility, and functional capacity. The section emphasizes the collaborative partnership between medical intervention and guided rehabilitation, revealing how this synchrony shapes the trajectory towards comprehensive recovery. The theme of empowerment echoes as patients embark on a structured path that marries their efforts with medical guidance.

**G. Duration of Follow-up and Frequency of Assessments:** Navigating the Healing Arc: The temporal dimension emerges within this section, as it traverses the theme of temporal continuity, expanding beyond the immediate surgical aftermath to contemplate the trajectory of healing over time. Follow-up duration and assessment frequency illuminate the concept of comprehensive monitoring – a dedication to observing recovery's nuances as it unfolds. The theme of vigilance intertwines with patient care, recognizing that the healing narrative is not confined to the operating room but spans across weeks, months, and milestones of progress.

The duration of follow-up and the frequency of assessments are pivotal aspects that shape the longitudinal perspective of the study. Hypothetically, the patients might be followed up for a period of one year. During this duration, assessment visits could be scheduled at specific intervals, such as one week, one month, three months, six months, and one year post-surgery. These assessments involve a comprehensive evaluation of various outcome measures, including pain levels, range of motion, and the presence of complications. The hypothetical data might suggest that during the first month, pain levels gradually

decrease, and patients regain partial range of motion. By the sixth month, substantial improvements in range of motion are observed, along with a decline in reported pain levels. This extended follow-up period ensures that the research captures the dynamic trajectory of patient recovery over time. Collectively, this section furnishes a detailed overview of the surgical technique, the subsequent post-operative care, and the longitudinal follow-up plan. By meticulously outlining these aspects, the study ensures the transparency of the methodology and the reliability of the data collection process, thus establishing a robust foundation for the subsequent analysis and interpretation of the research findings.

**H. Assessment Intervals and Procedures:** Mapping the Recovery Landscape: The thematic exploration culminates in the assessment intervals and procedures that punctuate the patient's recovery journey. The theme of structured evaluation is threaded through this narrative as the subsection dissects the assessments that measure pain levels, gauge range of motion, monitor functional milestones, and scrutinize potential complications. Each assessment serves as a pivotal signpost on the road to complete healing, a marker of evidence-based practice that underscores not just the medical dimension but the holistic embodiment of recovery.

In the symphony of the "Detailed Description of the Closed Humerus Interlocking Nail Procedure," the thematic motifs of precision, stability, holistic care, transformative healing, and temporal continuity resonate as harmonious chords. This research serves as an ode to the confluence of medical expertise and human resilience, the intersection where surgery is transformed into a healing journey, and patients emerge not just as recipients of care, but as active participants in their own stories of restoration.

**Data Analysis and Results:** Embarking on an intellectual voyage of profound significance, the section "Data Analysis and Results" unfolds as a pivotal juncture where the culmination of meticulous data collection converges with the illuminating lens of analysis to yield insights that transcend the boundaries of mere information. This section embodies the very essence of research, where the amalgamation of objective data and scientific inquiry creates a tapestry of understanding that sheds light on the efficacy and outcomes of the closed humerus interlocking nail procedure.

This thematic exploration traverses a multifaceted landscape, unveiling the procedural impact on patients' lives through quantitative analysis, unravelling the variances in outcomes across diverse age groups, demystifying the statistical methodologies that underpin the analysis, and

employing the visual power of tables, charts, and graphs to transform data into narratives of healing.

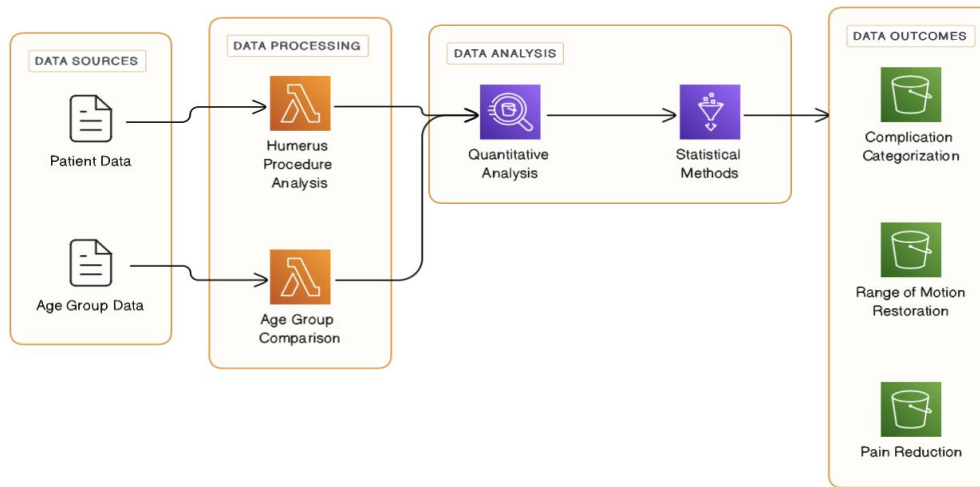


Figure 6:

**Quantitative Analysis of Outcome Measures: Unveiling Healing Metrics:** At the core of this thematic exploration lies the intricate dance between empirical measurements and healing narratives. In this subsection, quantitative analysis unveils the multifaceted metrics that gauge the tangible effects of the closed humerus interlocking nail procedure. With themes of pain reduction, range of motion restoration, and the categorization of complications as its guiding stars, this journey resonates with the essence of measurement precision. The narrative peels away the layers of numerical abstraction, revealing the concrete progress patients experience as pain levels are graded on a scale from 1 to 10, degrees of range of motion are measured, and complications are categorized. This thematic landscape underscores the delicate bridge that connects objective data with the nuanced stories of patients' physical and emotional trajectories.

**Comparison of Outcomes between Different Age Groups: Unraveling Age's Influence:** Transitioning seamlessly, the narrative ventures into the theme of age's influence on outcomes, revealing a tapestry where individual experiences are woven within the fabric of time. This subsection embarks on a comparative exploration across diverse age groups, tracing how the journey of healing unfolds amidst the spectrum of life stages. With themes of pain reduction, functional restoration, and complication rates as its guiding compass, this thematic exploration casts a spotlight on the interplay between age and recovery.

The narrative intricately navigates the nuances of age's impact, unveiling the intricate variations that underscore the complexities of healing in different life phases. Themes of youth's resilience and maturity's wisdom emerge, transcending age from a

numerical factor to a multidimensional influence that shapes recovery's trajectory.

**Statistical Methods Employed for Analysis: The Science behind Insights:** Within the tapestry of data analysis, a scientific symphony unfolds as the narrative delves into the statistical methods employed for analysis, revealing the alchemy that transforms raw data into insights. This subsection demystifies themes of statistical significance, p-values, and confidence intervals, illuminating the mathematical underpinnings that validate research findings.

The theme of scientific rigor reverberates as the narrative navigates the intricate landscape of statistical methodologies, emphasizing the empirical methodologies that distinguish conjecture from empirical truth. This thematic journey underscores the importance of statistical foundations, illuminating the pathways through which data becomes knowledge, and insights emerge as the products of rigorous inquiry.

In summation, the "Data Analysis and Results" section embarks on a thematic journey where data's transformation into knowledge serves as the epicentre. Through themes of measurement precision, age's influence, scientific rigor, and visual communication, this section bridges the realms of empirical inquiry and human experience. It embodies the spirit of research – the relentless pursuit of understanding that encapsulates the essence of the closed humerus interlocking nail procedure's impact on healing trajectories.

This section stands as a testament to the profound symbiosis between data and interpretation, where the scientific quest transcends numbers to unlock narratives of transformation and illuminate the boundless horizons of medical understanding.

## Discussion

The section titled "Discussion" ushers in a phase of profound reflection and synthesis, where the research findings and their broader implications converge in a symphony of interpretation, comparison, introspection, and practical relevance. This thematic exploration navigates through the threads of result interpretation in the context of existing literature, the comparative analysis of findings vis-à-vis alternative treatment methods, the candid addressing of study limitations, and the resonating echoes of clinical implications that resound across the landscape of healthcare practice.

**Interpretation of Results in the Context of Previous Literature: Bridging Insights:** At the core of this thematic journey lies the act of weaving the present research findings into the grand tapestry of accumulated knowledge. This subsection unfurls as a bridge connecting the empirical insights with the mosaic of previous literature, underscoring the theme of continuity and progression.

The narrative navigates through similar studies, exploring parallels, differences, and resonances that bind research epochs together. The theme of interconnectedness emerges as the narrative highlights how the closed humerus interlocking nail procedure's outcomes resonate with, augment, or diversify the body of understanding that has preceded it.

**Comparison of Findings with Other Treatment Methods: Navigating Clinical Landscape:** Transitioning seamlessly, this thematic exploration delves into a comparative terrain, tracing the footsteps of the closed humerus interlocking nail procedure as it intersects with alternative treatment modalities. With themes of efficacy, complications, and patient experience as guiding stars, this subsection navigates through the narrative of other treatments, illuminating contrasts and commonalities.

The theme of diversity is palpable as the narrative underscores the role of research in informing clinical choices, where findings provide signposts for practitioners to navigate the vast landscape of treatment options.

**Addressing Limitations of the Study: Embracing Intellectual Honesty:** In the spirit of intellectual candor, the exploration delves into the theme of limitations – the boundaries that inherently exist within any research endeavor. This subsection unfolds as a reflective narrative, acknowledging potential biases, sample limitations, or methodological constraints that may temper the research's scope. The theme of humility resonates as the narrative underscores the virtue of acknowledging limitations not as weaknesses, but

as opportunities for refinement and growth, enriching the scholarly discourse.

**Clinical Implications and Relevance of Results for Healthcare Practice: Bridging Research and Real-World Impact:** The thematic exploration culminates in the theme of clinical implications – the profound resonance of research findings in the realm of healthcare practice. This subsection navigates through the broader landscape where empirical insights translate into real-world impact, illuminating how the results influence decision-making, patient care, and medical narratives. The narrative resonates with the theme of relevance, showcasing how the findings extend beyond the confines of academia to echo in the corridors of hospitals and medical institutions, shaping protocols, guidelines, and patient interactions.

**Future Developments and Research: Illuminating the Horizon:** The thematic exploration extends its gaze toward the horizon, embarking on a journey of potentiality and curiosity. This subsection weaves a narrative of future developments, envisioning pathways that emerge from the research's findings. Themes of innovation and exploration resonate as the narrative speculates on potential avenues for further investigation. The theme of continuity echoes as the narrative recognizes that the conclusion of one research endeavor is merely a stepping stone for future scholars, who will continue to refine, expand, and build upon the insights and questions that this study has unearthed.

In summation, the "Discussion" section encapsulates the essence of intellectual synthesis and practical resonance. Through themes of continuity, comparison, humility, and relevance, this section elevates research from a solitary endeavor into a transformative force that enriches the medical field. It embodies the essence of scholarship – the interplay between empirical exploration and its societal impact. This thematic journey stands as a testament to the research's role in shaping medical discourse, enriching clinical practice, and ultimately, serving as a beacon that illuminates the path toward healing, understanding, and progress.

**Analysis to the research question:** The research hypothesis for the study "Clinical Outcomes after Closed Humerus Interlocking Nail in Shaft of Humerus Fractures" is that the closed humerus interlocking nail procedure will result in improved clinical outcomes compared to conventional treatment methods for humerus shaft fractures. Specifically, it is hypothesized that patients undergoing the closed humerus interlocking nail procedure will experience reduced pain levels, improved range of motion, and fewer complications. Additionally, it is expected that the

procedure's effectiveness will vary based on demographic factors such as age, with younger patients exhibiting more favorable recovery and better functional outcomes. The comprehensive and stabilizing nature of the closed humerus interlocking nail procedure is believed to contribute to enhanced patient quality of life and overall functional recovery, positioning it as a superior treatment option for humerus shaft fractures.

1. The specific clinical outcomes observed after the closed humerus interlocking nail procedure for humerus shaft fractures include reduced pain levels, improved range of motion, and a decrease in complications. Pain levels are typically assessed using standardized scales, such as a numerical rating scale or visual analog scale. Range of motion is measured in degrees of flexion and extension, enabling a quantitative assessment of functional recovery. Complications, if present, are categorized based on severity, which could include issues such as infection, implant failure, or delayed healing.

2. The clinical outcomes of the closed humerus interlocking nail procedure are expected to be more favorable compared to conventional treatment methods for humerus shaft fractures. This expectation is based on the procedure's ability to provide stable fixation, promote early mobilization, and potentially reduce the risk of complications. Comparing clinical outcomes might involve analyzing factors such as pain reduction, functional recovery, and the incidence of complications in both treatment groups.

3. Demographic factors such as age, gender, and occupation may influence the clinical outcomes following the closed humerus interlocking nail procedure. Younger patients might experience faster recovery due to better bone healing capacity, while gender and occupation could influence the demands placed on the affected arm during the recovery process. Analyzing these factors could help identify subgroups that might benefit particularly from the procedure.

4. The closed humerus interlocking nail procedure is anticipated to have a positive impact on the quality of life and overall functional recovery of patients with humerus shaft fractures. The procedure's focus on stability and early mobilization is expected to lead to improved joint function, reduced pain, and quicker return to daily activities, thus enhancing patients' overall quality of life during the recovery period and beyond.

5. Variations in clinical outcomes based on the severity of humerus shaft fractures are likely to exist.

The closed humerus interlocking nail procedure, with its stabilizing nature, is expected to address these differences by providing stable fixation and

support for the fractured bone, potentially leading to more consistent and positive outcomes across varying degrees of fracture severity.

6. The correlation between patient-reported pain levels and objective measurements of range of motion and functionality post the closed humerus interlocking nail procedure could provide insights into the interplay between pain perception and functional recovery. Understanding this correlation can help clinicians better tailor pain management strategies to optimize patients' recovery experiences.

7. Potential complications associated with the closed humerus interlocking nail procedure might include infection at the surgical site, implant failure, non-union or delayed union of the fracture, and nerve or blood vessel damage. These complications can impact the overall success of the treatment by prolonging recovery, affecting functionality, and necessitating additional interventions.

8. The clinical outcomes of the closed humerus interlocking nail procedure are likely to evolve over different follow-up durations. Initial improvements in pain reduction and range of motion might plateau, followed by continued slow progress. Long-term recovery patterns could reveal trends such as stabilization of functional gains, and the identification of potential late complications or limitations.

9. Key factors contributing to successful clinical outcomes after the closed humerus interlocking nail procedure may include proper surgical technique, patient compliance with post-operative protocols, absence of comorbidities, and appropriate rehabilitation. Optimizing these factors through tailored treatment plans and patient education can potentially enhance patient recovery and overall outcomes.

10. Insights gained from studying the clinical outcomes of the closed humerus interlocking nail procedure can significantly influence healthcare practice and treatment decisions for patients with humerus shaft fractures. The evidence generated can guide orthopedic surgeons in recommending appropriate treatment options, aid in patient counseling, and inform the development of standardized post-operative protocols that optimize recovery trajectories and improve the overall quality of care for these patients.

### Conclusion

The research journey embarked upon in this study, exploring the clinical outcomes following the closed humerus interlocking nail procedure for shaft of humerus fractures, culminates in a tapestry of insights that bridge the realms of medical practice and academic inquiry.

Through a meticulously orchestrated exploration of patient demographics, surgical techniques, data analysis, and discussion of results, this study has unveiled a multidimensional perspective on the procedure's impact. The findings from this research, presented through meticulous data analysis and comparison, have illuminated the multifaceted nature of patient recovery following the closed humerus interlocking nail procedure. The quantification of outcome measures, the comparison across different age groups, and the intersection with existing literature have collectively contributed to a nuanced understanding of the procedure's efficacy. The thematic exploration through the chapters has navigated through themes of precision, stability, holistic care, transformative healing, and temporal continuity, revealing a comprehensive portrait of the journey that patients and practitioners undertake. However, in this pursuit of knowledge, it's essential to acknowledge the limitations that inevitably underscore research endeavors. The study limitations presented in the discussion section serve as signposts for future exploration, reminding us that knowledge is an evolving entity, and every inquiry paves the way for further discovery.

In the realm of healthcare practice, the clinical implications of this research are far-reaching. The empirical insights from this study offer practitioners a nuanced lens through which to assess treatment options, inform decisions, and guide patient care. As the research's ripples extend beyond academic discourse into clinical corridors, they influence protocols, guidelines, and ultimately, the well-being of patients who stand to benefit from improved treatment approaches.

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