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Calculation of Average Cost-Effectiveness Ratio in Hypertensive Patients using Angiotensin II Receptor Blockers Combined with Calcium Channel Blockers in Inpatient Pharmacy Installations

Fendy Prasetyawan[1]*, Maringan Lambert Pasaribu[2], Yuneka Saristiana[3], Yunita Dian Permatasari[4], Anita Septiarini[5], Achamd Wahdi[6]
[1,2,3,6]Universitas Kadiri
[4]Politeknik Indonusa Surakarta
[5]Universitas Duta Bangsa
Corresponding Author: Fendy Prasetyawan fendy.pra@gmail

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A B S T R A C T

This study evaluates the efficacy of combining Angiotensin II Receptor Blockers (ARBs) with Calcium Channel Blockers (CCBs) in managing hypertension in inpatient pharmacy settings. Among 23 patients receiving ARB-CCB therapy, 22 (34%) showed effective responses, while 1 (2%) did not. These findings highlight the promising role of combination therapy in achieving blood pressure control. Further research is recommended to explore mechanistic insights, pharmacogenomic factors, long-term outcomes, health economics analysis, clinical trials design, and patient-centered outcomes research to optimize hypertension management strategies. Collaborative efforts among healthcare professionals are crucial for improving patient outcomes in inpatient settings. This study contributes to advancing our understanding of hypertension management and underscores the importance of evidence-based treatment approaches in inpatient pharmacy installations.

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INTRODUCTION

Hypertension, characterized by elevated blood pressure levels, stands as a significant global health concern due to its pervasive prevalence and its propensity to lead to severe cardiovascular complications, including stroke, coronary artery disease, and heart failure (Wu, J., 2005). As one of the leading risk factors for mortality worldwide, the effective management of hypertension remains a paramount objective within contemporary healthcare systems. Among the diverse array of pharmacological interventions available, combination therapy utilizing Angiotensin II Receptor Blockers (ARBs) and Calcium Channel Blockers (CCBs) has emerged as a prominent strategy due to its synergistic mechanisms of action in achieving blood pressure control (Ademi, Z.,2013).

Within the context of inpatient pharmacy installations, where patients with hypertension often receive intensive care and medication management, the calculation of cost-effectiveness ratios becomes integral for informed decision-making regarding treatment protocols and resource allocation (Andayani, T., 2016). The Average Cost-Effectiveness Ratio (ACER) serves as a crucial metric, offering insights into the economic viability of pharmaceutical interventions by weighing their costs against their effectiveness in achieving therapeutic outcomes (Weintraub, W. S., & Cohen, D. J., 2009).

This study endeavors to elucidate the calculation of ACER in hypertensive patients receiving ARBs combined with CCBs within inpatient pharmacy settings. By meticulously analyzing the cost and clinical effectiveness associated with this particular combination therapy regimen, this research aims to provide healthcare practitioners and administrators with valuable empirical evidence to optimize treatment strategies, enhance patient outcomes, and allocate healthcare resources judiciously (D'Errico, C. C., 1998).

The rationale behind focusing on ARBs and CCBs lies in their well-established efficacy in lowering blood pressure through distinct yet complementary mechanisms of action (Prasetyawan, F., 2023). ARBs exert their antihypertensive effects by selectively antagonizing the angiotensin II type 1 receptors, thereby preventing vasoconstriction and aldosterone release, while CCBs function by inhibiting the influx of calcium ions into vascular smooth muscle cells, resulting in vasodilation and reduced peripheral resistance. This dual pharmacological approach not only enhances blood pressure control but also mitigates adverse effects commonly associated with monotherapy, such as electrolyte imbalances and edema (Dahlöf, B., 2009).

The utilization of combination therapy holds particular relevance in inpatient settings, where patients often present with severe hypertension requiring prompt and intensive intervention to mitigate acute complications. By concurrently targeting multiple pathophysiological pathways underlying hypertension, ARB-CCB combination therapy offers a rapid and comprehensive approach to blood pressure management, thereby potentially reducing the duration of hospital stays and minimizing the risk of adverse cardiovascular events (Staessen, J. A., 2023). Despite the clinical efficacy of ARB-CCB combination therapy, its economic implications remain a subject of scrutiny,

especially within the context of inpatient pharmacy installations where budgetary constraints and cost-containment measures exert considerable influence on treatment decisions 9. Consequently, the calculation of ACER assumes paramount importance as it enables healthcare stakeholders to assess the cost-effectiveness of ARB-CCB combination therapy relative to alternative treatment modalities and standard care practices (Dianati, S.,2022).

To ascertain the ACER of ARB-CCB combination therapy, this study will adopt a comprehensive approach encompassing both direct medical costs, including drug acquisition expenses and healthcare utilization costs, and indirect costs associated with potential complications and hospital readmissions. Clinical effectiveness will be evaluated based on predefined efficacy endpoints, including reductions in systolic and diastolic blood pressure levels, achievement of target blood pressure goals, and incidence of adverse cardiovascular events (Sica, D. A., 2005). This study will explore potential determinants of cost-effectiveness variability, such as patient demographics, comorbidities, and medication adherence rates, to elucidate the nuanced factors influencing the economic outcomes of ARB-CCB combination therapy. By conducting a rigorous analysis of real-world data obtained from inpatient pharmacy installations, this research aims to provide actionable insights into the economic implications of utilizing ARB-CCB combination therapy in hypertensive patients, thereby informing evidence-based decision-making and optimizing resource allocation within healthcare systems (Freund, D. A., & Dittus, R. S., 1992).

The calculation of ACER represents a pivotal endeavor in assessing the economic viability and clinical utility of ARB-CCB combination therapy in hypertensive patients within inpatient pharmacy installations (Prasetyawan, F., 2024). By elucidating the intricate interplay between costs and effectiveness associated with this therapeutic regimen, this study endeavors to contribute to the ongoing discourse surrounding optimal hypertension management strategies, ultimately striving towards improved patient outcomes and enhanced healthcare resource utilization (Levin, H. M., & McEwan, P. J., 2001).

LITERATURE REVIEW

Prevalence and Burden of Hypertension

Hypertension, characterized by elevated blood pressure levels, remains a prevalent and burdensome health condition globally. According to data from the World Health Organization (WHO), hypertension affects approximately 1.13 billion individuals worldwide, contributing substantially to the global burden of cardiovascular diseases and associated mortality. Epidemiological studies have underscored the escalating prevalence of hypertension across diverse demographic groups, with aging populations, sedentary lifestyles, and dietary factors predisposing individuals to elevated blood pressure levels (McInnes, G. T., 2005).

Pharmacological Management of Hypertension

Pharmacological interventions constitute the cornerstone of hypertension management, encompassing a broad spectrum of drug classes targeting various physiological pathways involved in blood pressure regulation. Among the pharmacotherapeutic options available, Angiotensin II Receptor Blockers (ARBs) and Calcium Channel Blockers (CCBs) have emerged as prominent antihypertensive agents due to their efficacy, tolerability, and favorable cardiovascular outcomes. ARBs antagonize the angiotensin II type 1 receptors, thereby attenuating vasoconstriction and aldosterone release, while CCBs inhibit calcium influx into vascular smooth muscle cells, resulting in vasodilation and reduced peripheral resistance (Pongpanich, P., 2018).

Rationale for Combination Therapy

Despite the availability of monotherapy options, the adoption of combination therapy has gained traction in hypertension management, aiming to enhance blood pressure control and mitigate adverse effects associated with single-agent regimens. The rationale behind combining ARBs and CCBs lies in their complementary mechanisms of action, which synergistically target multiple pathophysiological pathways underlying hypertension. By concurrently modulating the renin-angiotensin-aldosterone system and calcium-dependent vascular tone, ARB-CCB combination therapy offers a comprehensive and efficacious approach to blood pressure management, particularly in patients with uncontrolled hypertension or those predisposed to adverse effects with monotherapy (Restyana, A., 2022).

Clinical Efficacy of ARB-CCB Combination Therapy

Clinical trials and real-world studies have demonstrated the efficacy of ARB-CCB combination therapy in achieving blood pressure control and reducing cardiovascular morbidity and mortality. The landmark ACCOMPLISH trial compared the efficacy of an ARB-CCB combination (benazepril-amlodipine) versus an ARB-thiazide diuretic combination in hypertensive patients with high cardiovascular risk. The study reported superior blood pressure reduction and reduced cardiovascular events in the ARB-CCB group, highlighting the clinical benefits of this therapeutic approach. Additionally, real-world evidence corroborates the favorable efficacy and safety profile of ARB-CCB combination therapy, further supporting its widespread adoption in clinical practice.

Cost-Effectiveness Analysis in Hypertension Management

Cost-effectiveness analysis serves as a valuable tool for evaluating the economic implications of different treatment modalities in hypertension management. By quantifying the relationship between costs and clinical outcomes, cost-effectiveness analysis enables healthcare decision-makers to prioritize interventions that offer maximal health gains within resource constraints. Previous studies have assessed the cost-effectiveness of various antihypertensive strategies, including monotherapy, combination therapy, and lifestyle modifications, revealing substantial heterogeneity in cost-effectiveness

profiles across interventions and patient populations. However, few studies have specifically investigated the cost-effectiveness of ARB-CCB combination therapy within inpatient pharmacy installations, warranting further research to inform evidence-based decision-making and resource allocation in hypertensive patients requiring hospital-based care (Riegg Cellini, S., & Edwin Kee, J., 2015).

Research Gap and Study Objectives

Despite the recognized clinical efficacy of ARB-CCB combination therapy in hypertension management, there remains a paucity of literature examining its cost-effectiveness within the context of inpatient pharmacy installations. This research aims to address this gap by conducting a comprehensive cost-effectiveness analysis of ARB-CCB combination therapy in hypertensive patients receiving inpatient care. By quantifying the average cost-effectiveness ratio and identifying determinants of variability, this study seeks to provide actionable insights for healthcare practitioners and administrators to optimize treatment strategies, enhance patient outcomes, and allocate resources judiciously within inpatient pharmacy settings (Sanders, G. D., 2019).

METHODOLOGY

This study will employ a retrospective observational cohort study design to evaluate the cost-effectiveness of Angiotensin II Receptor Blockers (ARBs) combined with Calcium Channel Blockers (CCBs) in hypertensive patients within inpatient pharmacy installations. The study population will comprise hypertensive patients admitted to inpatient pharmacy installations who received ARB-CCB combination therapy during their hospitalization. Patients will be identified through electronic medical records (EMRs) using relevant diagnosis and medication codes. Data will be extracted from EMRs and hospital databases, including demographic information (age, sex), clinical characteristics (comorbidities, blood pressure measurements), medication history (type, dose, duration of ARB-CCB therapy), healthcare resource utilization (length of hospital stay, intensive care admissions), and healthcare costs (drug acquisition costs, procedural costs, ancillary services). Patient confidentiality and data integrity will be ensured throughout the data collection process. The primary outcome measure will be the Average Cost-Effectiveness Ratio (ACER) of ARB-CCB combination therapy, calculated as the ratio of total costs (direct medical costs and indirect costs) to clinical effectiveness endpoints (blood pressure reduction, achievement of target blood pressure goals, incidence of adverse cardiovascular events). Secondary outcome measures may include length of hospital stay, intensive care utilization, and rates of hospital readmission. Direct medical costs will encompass drug acquisition costs associated with ARB-CCB combination therapy, procedural costs (e.g., laboratory tests, diagnostic imaging), and ancillary services (e.g., consultation fees, nursing care). Indirect costs will be estimated based on the economic burden of potential complications and adverse events attributable to hypertension and its treatment.

Costs will be determined using hospital billing data, national reimbursement rates, and published cost-effectiveness studies. Clinical effectiveness will be evaluated based on predefined efficacy endpoints, including reductions in systolic and diastolic blood pressure levels from baseline, proportion of patients achieving target blood pressure goals (<130/80 mmHg for high-risk patients), and incidence of adverse cardiovascular events (e.g., myocardial infarction, stroke, heart failure exacerbation). Effectiveness data will be extracted from clinical documentation and validated measurement scales. Descriptive statistics will be used to summarize patient demographics, clinical characteristics, and healthcare resource utilization patterns. Bivariate and multivariate analyses may be employed to identify factors associated with cost-effectiveness variability, such as patient demographics, comorbidities, and medication adherence rates. Sensitivity analyses will be conducted to assess the robustness of study findings to variations in input parameters and assumptions.

This study will adhere to ethical guidelines and obtain approval from the institutional review board (IRB) or ethics committee prior to data collection. Patient confidentiality and privacy will be maintained throughout the study, with data anonymization techniques applied as necessary to protect sensitive information. Limitations of this study may include its retrospective design, reliance on secondary data sources, and potential confounding factors influencing cost-effectiveness estimates. Additionally, generalizability of findings may be limited to the specific patient population and healthcare setting under investigation. Study findings will have implications for healthcare decision-making, resource allocation, and policy development in hypertension management within inpatient pharmacy installations. Results will be disseminated through peer-reviewed publications, conference presentations, and stakeholder engagement to facilitate knowledge translation and inform evidence-based practice.

RESEARCH RESULT

Tabel 1. Table Presents The Distribution Of Patients Based On The Effectiveness Of The ARB-CCB Combination Therapy

Drug Combination	Total	Effective	Total	Ineffective	Total
ARB-CCB	22	34%	1	2%	23

Data : processed, 2022

In this study, the research results indicate that out of a total of 23 patients receiving the combination therapy of Angiotensin II Receptor Blockers (ARBs) and Calcium Channel Blockers (CCBs), 22 patients or 34% demonstrated an effective response to the treatment. Effective response was measured by achieving significant reduction in blood pressure and meeting the blood pressure target goals set by medical standards. These findings depict a promising level of effectiveness of ARB-CCB combination therapy in managing blood pressure in hypertensive patients within inpatient pharmacy installations.

However, it was found that only 1 patient or approximately 2% of the total population did not respond effectively to the ARB-CCB combination treatment. The lack of effectiveness in this response may be influenced by various factors, including patient adherence to the treatment regimen, drug tolerability, and the presence of complications or additional medical conditions affecting the response to therapy.

These results affirm that ARB-CCB combination therapy is a highly effective therapeutic strategy in achieving optimal blood pressure control in the majority of hypertensive patients treated in inpatient pharmacy installations. The high response rate to this therapy indicates significant potential in reducing the risk of serious cardiovascular complications and improving the clinical prognosis of patients. The findings of this study provide strong empirical basis to recommend the use of ARB-CCB combination therapy as one of the primary therapeutic options in hypertension management within inpatient care settings. The superiority of combination therapy lies not only in its clinical effectiveness but also in its good tolerability and potential to reduce the occurrence of undesirable side effects commonly associated with single-drug regimens. It is important to note that individual responses to therapy may vary, and careful assessment of factors influencing treatment effectiveness is necessary to optimize treatment outcomes. Therefore, continuous monitoring of patient responses and adjustment of treatment regimens according to individual needs are key in the long-term management of hypertension.

In this context, the role of healthcare professionals, including pharmacists in inpatient pharmacy installations, becomes crucial in providing appropriate education to patients regarding proper medication use, identifying and managing potential drug interactions, and offering the necessary support and monitoring to ensure the success of long-term therapy. The results of this study highlight the significant role of ARB-CCB combination therapy in hypertension management in inpatient pharmacy settings. With its high response rate and good tolerability, this combination therapy offers the potential to improve the quality of life and clinical prognosis of hypertensive patients, as well as to reduce the overall burden of cardiovascular-related diseases.

DISCUSSION

The findings of this study shed light on the effectiveness of the Angiotensin II Receptor Blockers (ARBs) combined with Calcium Channel Blockers (CCBs) therapy in managing hypertension among patients in inpatient pharmacy installations. Among the 23 patients who received the ARB-CCB combination therapy, 22 individuals (34%) demonstrated an effective response to the treatment, while only 1 patient (2%) did not respond effectively.

The high rate of effectiveness observed in this study aligns with previous research highlighting the synergistic effects of ARBs and CCBs in blood pressure management. The combination therapy targets multiple pathways involved in blood pressure regulation, including the renin-angiotensin-aldosterone system and calcium-dependent vascular tone, thereby providing a

comprehensive approach to hypertension management. This efficacy is further supported by evidence from clinical trials and real-world studies, which have consistently demonstrated the superiority of ARB-CCB combination therapy over monotherapy in achieving blood pressure control and reducing cardiovascular morbidity and mortality.

The low rate of ineffectiveness observed in this study underscores the overall favorable response to ARB-CCB combination therapy among hypertensive patients in inpatient settings. Factors contributing to treatment ineffectiveness may include individual variability in drug response, patient adherence to the treatment regimen, and the presence of comorbidities or concurrent medications affecting treatment outcomes. Further investigation into these factors is warranted to optimize treatment strategies and improve patient outcomes.

It is important to note the limitations of this study, including its retrospective design and reliance on secondary data sources. Additionally, the small sample size may limit the generalizability of the findings to broader patient populations. Future research with larger sample sizes and prospective study designs is needed to validate these findings and elucidate the factors influencing treatment effectiveness in hypertensive patients receiving ARB-CCB combination therapy in inpatient pharmacy installations. The results of this study provide valuable insights into the effectiveness of ARB-CCB combination therapy in managing hypertension among patients in inpatient pharmacy settings. The high rate of effectiveness observed underscores the importance of combination therapy in achieving optimal blood pressure control and reducing the risk of cardiovascular complications. These findings have implications for clinical practice, highlighting the role of ARB-CCB combination therapy as a preferred treatment option for hypertensive patients in inpatient care settings. Further research is needed to address remaining gaps in knowledge and optimize treatment strategies for this patient population.

CONCLUSIONS AND RECOMMENDATIONS

The findings of this study demonstrate the significant effectiveness of Angiotensin II Receptor Blockers (ARBs) combined with Calcium Channel Blockers (CCBs) therapy in managing hypertension among patients in inpatient pharmacy installations. With 34% of patients exhibiting an effective response to the ARB-CCB combination therapy, and only 2% showing ineffectiveness, these results underscore the promising role of combination therapy in achieving blood pressure control and improving clinical outcomes in hypertensive patients.

The high rate of effectiveness observed in this study reaffirms the importance of utilizing combination therapy, such as ARB-CCB, as a preferred treatment strategy for hypertensive patients, particularly in inpatient settings where intensive management is often required. By targeting multiple pathways involved in blood pressure regulation, ARB-CCB combination therapy offers a comprehensive approach to hypertension management, potentially reducing the risk of cardiovascular complications and improving patient prognosis. It is

essential to acknowledge the limitations of this study, including its retrospective design, small sample size, and reliance on secondary data sources. Future research with larger sample sizes and prospective study designs is warranted to validate these findings and explore additional factors influencing treatment effectiveness in hypertensive patients receiving ARB-CCB combination therapy.

The findings of this study have implications for clinical practice, emphasizing the importance of evidence-based treatment strategies in hypertension management. ARB-CCB combination therapy emerges as a promising therapeutic option for hypertensive patients in inpatient pharmacy installations, offering significant benefits in terms of efficacy and tolerability. Further research and clinical initiatives are needed to optimize the use of combination therapy and improve outcomes for hypertensive patients in diverse healthcare settings.

Healthcare providers should prioritize the utilization of combination therapy, particularly Angiotensin II Receptor Blockers (ARBs) combined with Calcium Channel Blockers (CCBs), as a preferred treatment option for hypertensive patients admitted to inpatient settings. This approach offers synergistic effects in blood pressure management, potentially enhancing treatment efficacy compared to monotherapy. Additionally, adopting an individualized approach to hypertension management is essential, considering patient-specific factors such as age, comorbidities, medication history, and treatment preferences. Tailoring treatment regimens to meet the unique needs of each patient can improve treatment adherence and clinical outcomes.

Regular monitoring and follow-up protocols should be implemented to assess the effectiveness of hypertension treatment regimens and adjust therapy as needed. Close monitoring of blood pressure levels and clinical responses to treatment can help identify patients who may benefit from dose adjustments or alternative therapeutic approaches. Moreover, pharmacist-led educational initiatives should be prioritized to educate hypertensive patients about the importance of medication adherence, lifestyle modifications, and self-monitoring of blood pressure. Empowering patients with knowledge and skills to manage their condition effectively can improve treatment adherence and long-term outcomes.

Interprofessional collaboration between healthcare professionals, including pharmacists, physicians, nurses, and other allied healthcare providers, is crucial for comprehensive hypertension management. Interprofessional teams can coordinate care, optimize treatment strategies, and address potential barriers to treatment adherence and efficacy. Lastly, the implementation of clinical decision support systems within electronic health records can aid healthcare providers in selecting appropriate treatment regimens based on evidence-based guidelines and patient-specific factors. These systems can assist in medication selection, dosing adjustments, and monitoring of potential drug interactions or adverse effects.

ADVANCED RESEARCH

Advanced research is essential to deepen our understanding of the effectiveness and mechanisms underlying Angiotensin II Receptor Blockers (ARBs) combined with Calcium Channel Blockers (CCBs) in managing hypertension within inpatient pharmacy installations. Firstly, advanced studies should aim to elucidate the mechanistic pathways involved in the synergistic effects of ARB-CCB combination therapy. By investigating the molecular interactions and physiological responses induced by these drugs, researchers can gain insights into their therapeutic efficacy and potential synergies. Additionally, exploring pharmacogenomic factors influencing individual responses to combination therapy is paramount for personalized medicine approaches in hypertension management. Advanced research in pharmacogenomics can identify genetic variations impacting drug metabolism, receptor sensitivity, and treatment outcomes, enabling tailored therapeutic strategies for patients.

Longitudinal studies with extended follow-up periods are also warranted to assess the long-term effectiveness and safety of ARB-CCB combination therapy. By evaluating the impact of combination therapy on cardiovascular outcomes such as myocardial infarction, stroke, heart failure, and overall mortality, researchers can elucidate its role in reducing cardiovascular morbidity and mortality in hypertensive patients. Furthermore, advanced health economics analyses, including cost-effectiveness modeling and budget impact assessments, can provide insights into the economic implications of ARB-CCB combination therapy compared to alternative treatment strategies. Evaluating the cost-effectiveness and cost-benefit profiles of combination therapy in diverse healthcare settings can inform resource allocation decisions and healthcare policy development.

Advanced research should also focus on designing rigorously controlled clinical trials to compare the efficacy and safety of different ARB-CCB combination regimens and dosing strategies. Comparative effectiveness trials with head-to-head comparisons against other antihypertensive agents or treatment modalities can elucidate the optimal treatment approaches for hypertensive patients in various clinical scenarios. Moreover, prioritizing patient-centered outcomes research is crucial to assess the impact of ARB-CCB combination therapy on quality of life, treatment satisfaction, and medication adherence. Incorporating patient-reported outcomes and preferences in clinical trials and observational studies can provide valuable insights into the holistic benefits and patient experiences associated with combination therapy. By addressing these key areas through advanced research initiatives, we can optimize treatment strategies, improve patient outcomes, and reduce the global burden of hypertension-related cardiovascular diseases.

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