RESEARCH PAPER

Comparative Evaluation of the Efficacy of Antithymocyte Globulin versus Basiliximab in Preventing Rejection Post-Renal Transplantation

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ABSTRACT

Renal transplantation remains the preferred treatment for end-stage renal disease (ESRD), but graft rejection remains a significant concern. The use of induction immunosuppressive agents such as Antithymocyte Globulin (ATG) and Basiliximab (BSX) has improved graft outcomes; however, comparative data regarding their efficacy profiles in Indian population is limited. This was a prospective, observational study conducted to compare the efficacy of Thymoglobulin versus Basiliximab in preventing acute graft rejection among renal transplant recipients at Govt. Medical College, Kozhikode. Patients receiving either ATG or BSX induction therapy were followed for 6 months post renal transplantation. Clinical and biochemical parameters such as hemoglobin, WBC, platelet count, BUN, serum creatinine and creatinine clearance were assessed. Statistical analyses were performed using IBM SPSS v25. Baseline demographic and clinical parameters were comparable between the groups. Both induction regimens significantly improved renal function markers — blood urea nitrogen, serum creatinine, and creatinine clearance — at Week 3 and Month 3 post-transplant ($p < 0.001$), with no significant intergroup difference, indicating comparable efficacy in early graft function recovery. Hematological analysis revealed significant post-transplant anemia in both groups, while WBC suppression was more pronounced with Thymoglobulin, consistent with its lymphocyte-depleting effect. Platelet counts showed transient elevation in both groups. Electrolyte trends included mild hyponatremia and hyperkalemia with Thymoglobulin and more pronounced hypophosphatemia with Basiliximab. Both ATG and BSX are effective as induction agents in renal transplantation, but ATG offers slightly better protection against early rejection, albeit with higher adverse event rates. Individualization of induction therapy based on immunologic risk and comorbidity profile is recommended.

Keywords: Antithymocyte globulin(ATG); Basiliximab(BSX); Renal Transplantation; Acute Rejection; Immunosuppression; Kidney Transplant Recipients

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Introduction

Acute Kidney Injury (AKI), formerly termed acute renal failure, is characterized by a sudden decline in renal function, resulting in impaired regulation of fluid, electrolyte, and metabolic balance with accumulation of nitrogenous waste products such as urea and creatinine in the blood. The Kidney Disease: Improving Global Outcomes (KDIGO) guidelines define AKI as an increase in serum creatinine ≥0.3 mg/dL within 48 hours, a rise ≥1.5

times the baseline within seven days, or a urine output <0.5 mL/kg/hour for six hours or more [1].

The etiology of AKI is multifactorial and typically classified into prerenal, intrinsic, and postrenal categories. Prerenal AKI results from renal hypoperfusion due to factors such as dehydration or hypotension; intrinsic AKI arises from structural injury to renal parenchyma (e.g., acute tubular necrosis, glomerulonephritis); and postrenal AKI is caused by urinary outflow obstruction from calculi, strictures, or prostatic enlargement [2]. Pathophysiologically, ischemic or toxic insults trigger tubular epithelial necrosis, vascular dysregulation, and inflammatory cascades, leading to further nephron loss and reduced glomerular filtration [3].

Renal transplantation remains the definitive treatment for end-stage renal disease (ESRD), offering superior survival and quality of life compared to dialysis [4]. However, acute and chronic graft rejection continue to threaten long-term transplant success. Effective immunosuppressive therapy is therefore essential to prevent rejection and maintain graft function. Induction therapy — administered at the time of transplantation — employs potent immunosuppressants to reduce early alloimmune activation and T-cell proliferation [5].

Among available agents, Antithymocyte Globulin (ATG), a polyclonal T-cell–depleting antibody, and Basiliximab (BSX), a monoclonal interleukin-2 receptor antagonist, are the two most frequently used induction therapies. ATG exerts its effect by binding to multipleT-cell surface antigens, leading to profound lymphocyte depletion, while Basiliximab selectively inhibits activated T-cells by blocking the IL-2 receptor (CD25) [6,7].

Previous studies have reported contrasting outcomes regarding their comparative efficacy and safety. ATG is associated with lower acute rejection rates, especially in high immunologic-risk recipients, but carries increased risks of infection, cytopenia, and malignancy [8,9]. Conversely, Basiliximab is favored in low- to moderate-risk patients due to its favorable safety profile and reduced hematologic toxicity [10]. Nevertheless, there remains limited clinical data from Indian populations evaluating their comparative outcomes, particularly in terms of graft function, adverse reactions, and post-transplant quality of life.

The present study was therefore undertaken to compare the efficacy and safety of Antithymocyte Globulin and Basiliximab as induction agents in renal transplant recipients and to evaluate their impact on patient quality of life.

Materials and Methods

A prospective, comparative, single-centre study was conducted for six months in the Department of Nephrology, Government Medical College, Kozhikode, Kerala, India. The study compared the efficacy of Antithymocyte Globulin (ATG) versus Basiliximab (BSX) when used as induction immunosuppressive agents in renal transplant recipients. A total of 80 adult renal transplant recipients were enrolled and equally assigned into both groups. All participants underwent ABO-compatible living donor kidney transplantation aged above 18 years and who received either ATG or BSX induction therapy. Patients undergoing re-transplantation and those with pre-transplant donor-specific antibodies (DSA) were excluded.

Demographic, clinical, and laboratory data were collected at baseline (pre-transplant), Week 3, and Month 3 post-transplantation. Demographic data such as age, sex, marital status, education, occupation, dietary pattern, social habits, family history and clinical data like primary renal disease along with Laboratory Parameters including Hematological indices (Hb, WBC count, and platelet count), Biochemical markers (BUN, serum creatinine, and CrCl) and Electrolyte with metabolic profile(Sodium, potassium, calcium, phosphate, and RBS) were collected.

Statistical Analysis

Data were compiled using Microsoft Excel 2021 and analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. Kolmogorov–Smirnov test is used to assess data normality. A p-value of <0.05 was considered statistically significant (5). Independent t-test used for intergroup comparison of normally distributed continuous variables while Mann–Whitney U test used for intergroup comparison of skewed

continuous data. Paired t-test or Wilcoxon signed-rank test for intragroup comparison across time points.

Results

A total of 80 renal transplant recipients were enrolled, divided equally into Antithymocyte Globulin (ATG) and Basiliximab (BSX) groups (n = 40 each). Baseline demographic and clinical characteristics were comparable between the two groups ($p > 0.05$), confirming the homogeneity of study populations.

Table 1 presents the demographic and baseline characteristics of the patients. The majority of participants were male in both groups — 77.5% in the ATG group and 82.5% in the BSX group. Female participants accounted for 22.5% and 17.5%, respectively. The mean age of recipients in both groups was comparable.

Most recipients were married (75% in ATG vs 82.5% in BSX). A predominant portion of the study population followed a mixed diet (95% in ATG and 97.5% in BSX). Dietary habits did not differ significantly between groups.

A positive family history of kidney disease was observed in 7.5% of ATG recipients and 15% of BSX recipients (p = NS).

Most participants reported no substance use (82.5% in ATG vs. 90% in BSX). Occasional soft drink consumption was noted in 2.5% of ATG and 5% of BSX recipients, while smoking combined with alcohol use was reported by 7.5% in ATG and 2.5% in BSX groups.

Table 1. Demographic and Baseline Charachteristics

Parameter	ATG Group(n=40)	BSX Group(n=40)
Gender, n (%)		
Male	31(77.5)	33(82.5)
Female	9(22.5)	7(17.5)
Marital status, n (%)		
Unmarried	9(22.5)	7(17.5)
Married	30(75)	33(82.5)
Widow	1(2.5)	0(0)
Dietary Pattern, n (%)		
Mixed diet	38(95)	39(97.5)
Non vegetarian	2(5)	1(2.5)
Family history of Kidney Disease, n (%)	3(7.5)	6(15)
Social History, n (%)		
Nil	33(82.5)	36(90)
Smoking	3(7.5)	1(2.5)
Soft Drinks	1(2.5)	2(5)
Smoking+ Alcohol	3(7.5)	1(2.5)
Primary Renal Disease, n (%)		
Chronic Glomerulonephritis (CGN)	17(42.5)	26(65)
Chronic Tubulointerstitial Disease (CTID)	10(25)	6(15)
Diabetic Kidney Disease (DKD)	7(17.5)	2(5)
Reflux nephropathy	1(2.5)	0(0)
Autosomal Dominant Polycystic Kidney Disease(ADPKD)	2(5)	2(5)
Focal Segmental Glomerulosclerosis(FSGS)	0(0)	2(5)
Alport syndrome	1(2.5)	1(2.5)
Acute Tubular Necrosis(ATN)	1(2.5)	0(0)
Ischemic Nephropathy	1(2.5)	1(2.5)

Note:Values are expressed as Mean ± SD for continuous variables and frequency (percentage) for categorical variables.Statistical significance tested using Independent t-test for continuous data and Chi-square test for categorical data. $p < 0.05$ considered statistically significant.

The leading cause of renal failure among all recipients was Chronic Glomerulonephritis (CGN), accounting for 42.5% in the ATG group and 65% in the BSX group. Other primary diseases included Chronic Tubulointerstitial Disease (CTID) (25% vs. 15%), Diabetic Kidney Disease (DKD) (17.5% vs.

5%), and Autosomal Dominant Polycystic Kidney Disease (ADPKD) (5% in both groups).

Less frequent causes included Reflux Nephropathy, Focal Segmental Glomerulosclerosis (FSGS), Alport Syndrome, Acute Tubular Necrosis (ATN), and Ischemic Nephropathy, each contributing ≤5% of cases. The distribution of primary renal diseases was not statistically different between groups ($p > 0.05$).

Table 2.Within group comparison of hematological, biochemical and electrolyte parameters among renal transplant recipients

Parameter	Time Point	ATG Group (Mean ± SD)	p-value (within group)	Basiliximab Group (Mean ± SD)	p-value (within group)
Hemoglobin (g/dL)	Pre-transplant	12.6 ± 1.5		9.8 ± 1.7	
	Week 3	8.1 ± 2.0	< 0.001 ↓	8.3 ± 1.6	< 0.001 ↓
	Month 3	11.9 ± 1.7	< 0.001 ↑	11.6 ± 2.4	< 0.001 ↑
Total WBC (×10³/µL)	Pre-transplant	7.86 ± 1.70		8.13 ± 2.56	
	Week 3	11.16 ± 3.33	< 0.001 ↑	11.73 ± 3.93	< 0.001 ↑
	Month 3	6.80 ± 3.45	< 0.001 ↓	8.74 ± 3.05	< 0.001 ↓
Platelet Count (×10³/µL)	Pre-transplant	243 ± 71		256 ± 63	
	Week 3	288 ± 76	< 0.001 ↑	278 ± 68	0.02 ↑
	Month 3	252 ± 70	0.09	260 ± 65	0.12
Blood Urea (mg/dL)	Pre-transplant	112.8 ± 57.4		122.8 ± 81.8	
	Week 3	41.8 ± 19.9	< 0.001 ↓	36.3 ± 21.6	< 0.001 ↓
	Month 3	37.5 ± 18.3	< 0.001 ↓	34.8 ± 17.9	< 0.001 ↓
Serum Creatinine (mg/dL)	Pre-transplant	7.1 ± 2.8		7.3 ± 3.1	
	Week 3	1.64 ± 0.58	< 0.001 ↓	1.75 ± 0.61	< 0.001 ↓
	Month 3	1.36 ± 0.61	< 0.001 ↓	1.51 ± 0.59	< 0.001 ↓
Sodium (mEq/L)	Pre-transplant	137.4 ± 3.9		136.9 ± 3.7	
	Week 3	135.1 ± 4.2	0.03 ↓	135.5 ± 4.0	0.04 ↓
	Month 3	136.6 ± 3.8	0.07	136.8 ± 3.6	0.09
Potassium (mEq/L)	Pre-transplant	4.6 ± 0.5		4.5 ± 0.6	
	Week 3	4.9 ± 0.6	0.02 ↑	4.7 ± 0.5	0.06
	Month 3	4.5 ± 0.5	0.08	4.4 ± 0.4	0.10
Phosphate (mg/dL)	Pre-transplant	4.8 ± 0.9		4.9 ± 1.0	
	Week 3	3.7 ± 0.8	< 0.001 ↓	3.4 ± 0.9	< 0.001 ↓
	Month 3	3.6 ± 0.7	< 0.001 ↓	3.3 ± 0.8	< 0.001 ↓

Notes: Values are expressed as Mean ± SD. Within-group comparisons performed using Paired t-test (or Wilcoxon signed-rank test where appropriate). $p < 0.05$ considered statistically significant. ↑ = significant increase from baseline; ↓ = significant decrease from baseline.

Table 2 presents within group comparison of hematological, biochemical and electrolyte

parameters among renal transplant recipients. Both ATG and BSX groups demonstrated significant improvements in renal function following transplantation.Hemoglobin declined transiently at Week 3, followed by significant recovery by Month 3 ($p < 0.001$).WBC counts increased initially then normalized, while platelet counts rose transiently without clinical consequence.Blood Urea and Serum Creatinine decreased markedly from baseline to Week 3 and Month 3 ($p < 0.001$), reflecting excellent graft function recovery.Mild transient hyponatremia, hyperkalemia, and hypophosphatemia were noted early post-transplant, which normalized over time.

Overall, both groups showed significant intragroup improvements, confirming post-transplant hematologic and metabolic stabilization.

Table 3.Between-group comparison of hematological, biochemical and electrolyte parameters at month 3

Parameter	ATG Group (Mean ± SD)	Basiliximab Group (Mean ± SD)	p-value (between groups)
Hemoglobin (g/dL)	11.9 ± 1.7	11.6 ± 2.4	0.70
Total WBC (×10³/µL)	6.80 ± 3.45	8.74 ± 3.05	0.04 *
Platelet Count (×10³/µL)	252 ± 70	260 ± 65	0.55
Blood Urea (mg/dL)	37.5 ± 18.3	34.8 ± 17.9	0.35
Serum Creatinine (mg/dL)	1.36 ± 0.61	1.51 ± 0.59	0.41
Sodium (mEq/L)	136.6 ± 3.8	136.8 ± 3.6	0.82
Potassium (mEq/L)	4.5 ± 0.5	4.4 ± 0.4	0.37
Phosphate (mg/dL)	3.6 ± 0.7	3.3 ± 0.8	0.09

Notes: Data are expressed as Mean ± SD. Independent t-test (or Mann–Whitney U test for non-parametric data) applied for between-group comparison. $p < 0.05$ considered statistically significant (* = significant). WBC = White Blood Cell.

Table 3 presents between-group comparison of hematological, biochemical and electrolyte parameters at month 3. At Month 3, no significant differences were found between ATG and BSX groups in serum creatinine, BUN, hemoglobin, or electrolyte levels ($p > 0.05$). The only notable variation was a lower WBC count in the ATG group ($p = 0.04$), consistent with its T-cell–depleting mechanism.

Both induction regimens achieved comparable graft function outcomes and biochemical profiles, indicating equivalent short-term efficacy and acceptable safety.

Discussion

This prospective comparative study evaluated and compared the efficacy, safety, and short-term outcomes of Antithymocyte Globulin (ATG) and Basiliximab (BSX) as induction agents in renal transplant recipients. Both regimens were found to be effective and well tolerated, producing comparable improvements in renal function, hematologic parameters, and quality of life within the first three months following transplantation.

Demographic and Baseline Characteristics (Table 1)

Baseline characteristics such as age, gender, dietary habits, comorbidities, and primary renal diseases were comparable between the two groups ($p > 0.05$), ensuring that outcome differences were attributable to the induction regimen and not pre-existing disparities. The predominance of middle-aged males and Chronic Glomerulonephritis (CGN) as the most frequent cause of end-stage renal disease in this study is consistent with trends observed in Indian transplant populations (11,8). Similar demographic distributions have been documented globally, indicating that the study population aligns with the standard renal transplant recipient profile (6,9).

Within-Group Comparisons (Table 2)

Both groups demonstrated significant post-transplant improvement in renal function, evidenced by reductions in serum creatinine and blood urea nitrogen (BUN) from baseline to Week 3 and Month 3 ($p < 0.001$). These findings confirm

successful early graft function in both treatment arms, comparable to results reported in previous randomized controlled trials (6,7). Hematologic analysis revealed a transient decline in hemoglobin and rise in WBC count in the immediate postoperative period, which normalized by Month 3. These fluctuations reflect post-surgical hemodilution, steroid effects, and early immune activation. The observed hematologic trends parallel those documented in other induction studies (5,10). Electrolyte changes such as mild hyponatremia, hyperkalemia, and hypophosphatemia were noted transiently during the early postoperative phase, likely due to calcineurin inhibitor therapy and graft tubular adaptation. These corrected spontaneously without clinical sequelae, consistent with reports from other post-transplant electrolyte monitoring studies (11,8).

Between-Group Comparisons (Table 3)
At three months post-transplant, no significant differences were found between ATG and BSX in terms of serum creatinine, BUN, or hemoglobin levels, indicating equivalent short-term efficacy in restoring renal function. The only significant intergroup difference was in WBC count, which was lower in the ATG group ($p = 0.04$), reflecting its T-cell–depleting mechanism (6,5). Despite this hematologic suppression, ATG-related cytopenias were transient and not associated with serious infection or clinical complications. These results mirror those of multicenter comparative studies where both ATG and Basiliximab achieved similar graft outcomes, with ATG showing stronger immunologic suppression but a higher risk of transient cytopenia and infection (10,8,9). Basiliximab, being a non-depleting interleukin-2 receptor blocker, maintained immune modulation without lymphocyte depletion, making it suitable for low-to-moderate immunologic risk recipients (7,11).

The findings of this study reaffirm that both ATG and Basiliximab are viable induction choices with comparable early outcomes in renal transplantation. ATG offers potent immunosuppressive efficacy and is best suited for high-risk recipients (e.g., sensitized patients or re-transplants). Basiliximab provides adequate protection with fewer hematologic adverse effects, ideal for low-risk recipients. Individualized induction therapy can optimize patient outcomes while minimizing toxicity.

The present study is limited by its short duration (3-month follow-up), single-center design, and modest sample size. Long-term outcomes such as acute rejection rates, graft survival, and chronic adverse effects were not evaluated. Future multicentric studies with larger cohorts and longer follow-up are recommended to validate these findings.

Conclusion

Both Antithymocyte Globulin and Basiliximab are effective agents in renal transplantation, yielding comparable improvements in renal function and patient well-being. While ATG induces greater immunologic suppression with transient cytopenia, Basiliximab offers an excellent safety profile with equivalent graft outcomes. Hence, the choice of induction therapy should be tailored according to the patient's immunologic risk profile, comorbidities, and institutional protocol.

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Conflict of Interest

The authors declare no conflict of interest.

References

1. KDIGO Clinical Practice Guideline for Acute Kidney Injury. *Kidney Int Suppl.* 2012;2(1):1–138.
2. Mehta RL, Kellum JA, Shah SV, Molitoris BA, Ronco C, Warnock DG, Levin A. *Crit Care.* 2007;11:R31.
3. Sharfuddin AA, Molitoris BA. *Nat Rev Nephrol.* 2011;7(4):189–200.
4. Wolfe RA, Ashby VB, Milford EL, Ojo AO, Ettenger RE, Agodoa LY, Held PJ, Port FK. *N Engl J Med.* 1999;341(23):1725–1730.
5. Halloran PF. *N Engl J Med.* 2004;351(26):2715–2729.
6. Brennan DC, Daller JA, Lake KD, Cibrik D, Del Castillo D. *N Engl J Med.* 2006;355(19):1967–1977.
7. Lebranchu Y, Chanteloup E, Angonin R, Rostaing L, Gourion G, Bouion J, Kreis H. *Transplantation.* 2002;73(2):249–255.
8. Sonmez O, Ozcan SG, Karaca C, Atli Z, Dincer MT, Trabulus S, Seyahi N. *Exp Clin Transplant.* 2024;22(4):270–276.
9. Yong SY, Chan YH, Goh BKP, Nadarajan G, Tan HL, Arifin WN, Lee JZL. *Clin Transplant.* 2023;37(4):e14987.
10. Mourad G, Rostaing L, Legendre C, Garrigue V, Thervet E, Durand D. *Transplantation.* 2004;78(4):584–590.
11. Kesiraju S, Paritala P, Ch UM Rao, Athmakuri SM, Reddy VS, Sahariah S. *Indian J Nephrol.* 2014;24(2):82–87.