

Systematic Review of Bortezomib-based Desensitization Therapy in Sensitized Kidney Transplant Candidates: Efficacy, Safety, and Clinical Outcomes

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INTRODUCTION

Kidney transplantation is the ultimate and best possible treatment for many patients with end-stage renal disease.^[1] However, sensitization, characterized by the presence of anti-human leukocyte antigens (anti-HLA) antibodies, poses a significant obstacle to successful kidney transplantation.^[2-4] Sensitization also results in the development of donor-specific antibodies (DSA), which not only reduces the likelihood of receiving a suitable donor but also leads to antibody-mediated graft rejection (AMR), a major cause of graft loss. AMR and worse outcomes in transplantation, particularly for

ABSTRACT

Objective: Highly sensitized kidney transplant candidates, those with high levels of antihuman leukocyte antigens antibodies, are at increased risk of antibody-mediated graft rejection. The goal of desensitization therapy is to reduce alloantibody titers and increase the chance and success of transplantation. The proteasome inhibitor bortezomib, which acts against plasma cells, has been reported to be an effective agent in this setting. This systematic review evaluates the efficacy and safety of bortezomib-based desensitization regimens in sensitized kidney transplant recipients. **Methods:** A systematic search of various databases was conducted between January 2005 and July 2025. Studies that considered sensitized kidney transplant candidates treated with bortezomib-based desensitization were included, and outcomes included reduction in donor-specific antibodies (DSA), engraftment rate, graft rejection, and adverse events. **Findings:** A total of 21 studies involving about 185 patients were included, comprising 11 case reports, 6 case series, and 4 clinical trials or prospective studies. Overall graft success rate was 87% rejection-free outcomes 76% and no more adverse events in 81%. While most studies showed significant DSA reduction, one reported limited effectiveness. Bortezomib was generally well-tolerated, with no major adverse events in approximately 81% of studies. Mild neuropathy was noted in some cases, and treatment discontinuation occurred in 20% of patients in one trial. **Conclusion:** It can be concluded that bortezomib-based therapies are a potentially effective and well-tolerated option for desensitization and treatment of antibody-mediated rejection in kidney transplant candidates.

KEYWORDS: Antibody-mediated rejection, bortezomib, desensitization therapy, donor-specific antibodies, kidney transplantation

HLA-and ABO-mismatched grafts, are major issues in sensitized kidney transplant candidates.^[5,6] The literature reports suggest that 12%–37% of kidney transplant recipients with acute AMR do not respond to treatment and eventually lose their grafts.^[7]

Desensitization protocols are being used to reduce DSA titers and improve transplant eligibility in sensitized

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kidney transplant candidates in an attempt to decrease the likelihood of organ rejection.^[8,9] Traditional approaches, including plasmapheresis, rabbit antithymocyte globulin, intravenous immunoglobulin (IVIG), rituximab (an anti-CD20 monoclonal antibody), primarily deplete immature B-cells but not mature plasma cells that produce antibodies against HLA.^[10-12] Bortezomib, a selective inhibitor of the 26S proteasome, first approved by US FDA for the treatment of multiple myeloma.^[13-16] Bortezomib has been used in kidney recipients offers a novel mechanism of desensitization in which it actively induces apoptosis in plasma cells that are responsible for producing DSAs which are critical in AMR.^[17-21]

Although promising, the use of bortezomib as a first-line agent for the treatment of antibody resistance or in desensitization protocols remains limited and results on this topic are conflicting. For example, study by Sberro-Soussan *et al.* reported no positive effect of bortezomib-based therapy and no decrease of DSA within the 150-day and 270-day posttreatment period in any patient.^[17,22,23] Nonetheless, numerous studies have shown that bortezomib has a beneficial impact on kidney transplant success. The purpose of this systematic review is to assess the effects of bortezomib-based therapy, either by itself or in conjunction with other drugs such as rituximab or IVIG, in recipients of kidney transplants who are sensitive to this topic because the results are controversial and no systematic study has been conducted on this subject to date.

METHODS

Although not prospectively registered, this review follows PRISMA-2021 and is compatible with PROSPERO standards. All stages including the literature search, study selection, and quality assessment were conducted independently by two authors, with disagreements resolved through discussion or, when necessary, consultation with a third reviewer.

Search strategy

A systematic search was conducted across multiple databases, including PubMed, Scopus, Embase, Cochrane CENTRAL, and Google Scholar, covering the period from January 2005 to July 2025. The search was limited to English-language studies involving human subjects. Keywords and MeSH terms used included: “*bortezomib*,” “*desensitization*,” “*sensitized*,” “*kidney transplant*,” “*DSA*,” “*HLA antibodies*,” and “*proteasome inhibitor*.” A detailed search strategy is provided in the Appendix 1.

Eligibility criteria

PICO in our systematic review were: Population: High immunologic risk kidney transplant recipients;

Intervention: Bortezomib (monotherapy or in combination) for desensitization; and Outcomes: DSA reduction, transplant occurrence, AMR, graft survival, adverse events. Clinical trials, observational studies, case series, and case-reports were included in the study. The exclusion criteria were animal or *in vitro* studies, abstracts, editorials, and reviews.

Data extraction

Data were extracted on study design, patient characteristics, bortezomib regimen, outcomes, and adverse events. Due to heterogeneity, qualitative synthesis was performed.

Quality assessment

The quality of included studies was assessed using appropriate tools based on study design: Cochrane RoB 2.0 for randomized trials, ROBINS-I for nonrandomized studies, and JBI critical appraisal checklists for case series and case reports. Smaller case series and individual case reports were assessed narratively due to their descriptive nature and limited methodological detail.

RESULTS

Literature search

Figure 1 shows the study selection flowchart, whereas Table 1 details the characteristics and summary of extracted data of each included study.

A total of 21 studies were included in the review,^[7,10,18,23-38,40,41] encompassing approximately 185 patients. Among these, 11 were case reports involving individual patients or small groups (typically 1–4 patients), and 6 were case series reporting on multiple patients without a formal trial design. In addition, 3 studies were identified as clinical trials and 1 as prospective cohort, including those by Jeong *et al.*,^[28] Diwan *et al.*,^[31] Moreno Gonzales *et al.*,^[32] and Schmidt *et al.*^[34] These studies varied in design and population size but collectively provided insight into the use of bortezomib for desensitization or treatment of antibody-mediated rejection in kidney transplantation.

Graft success/transplantation rate

In studies that have reported transplant outcomes, about 87% (about 39 out of 45 patients) have reported successful transplantation without the occurrence of rejection. One study reported that the engraftment rate in the bortezomib group was 42% versus 24% in the control group.^[28] The transplant success rate has been reported to be 93% by Park *et al.*^[35] Most case reports/series have also indicated successful transplantation and sustained kidney function.

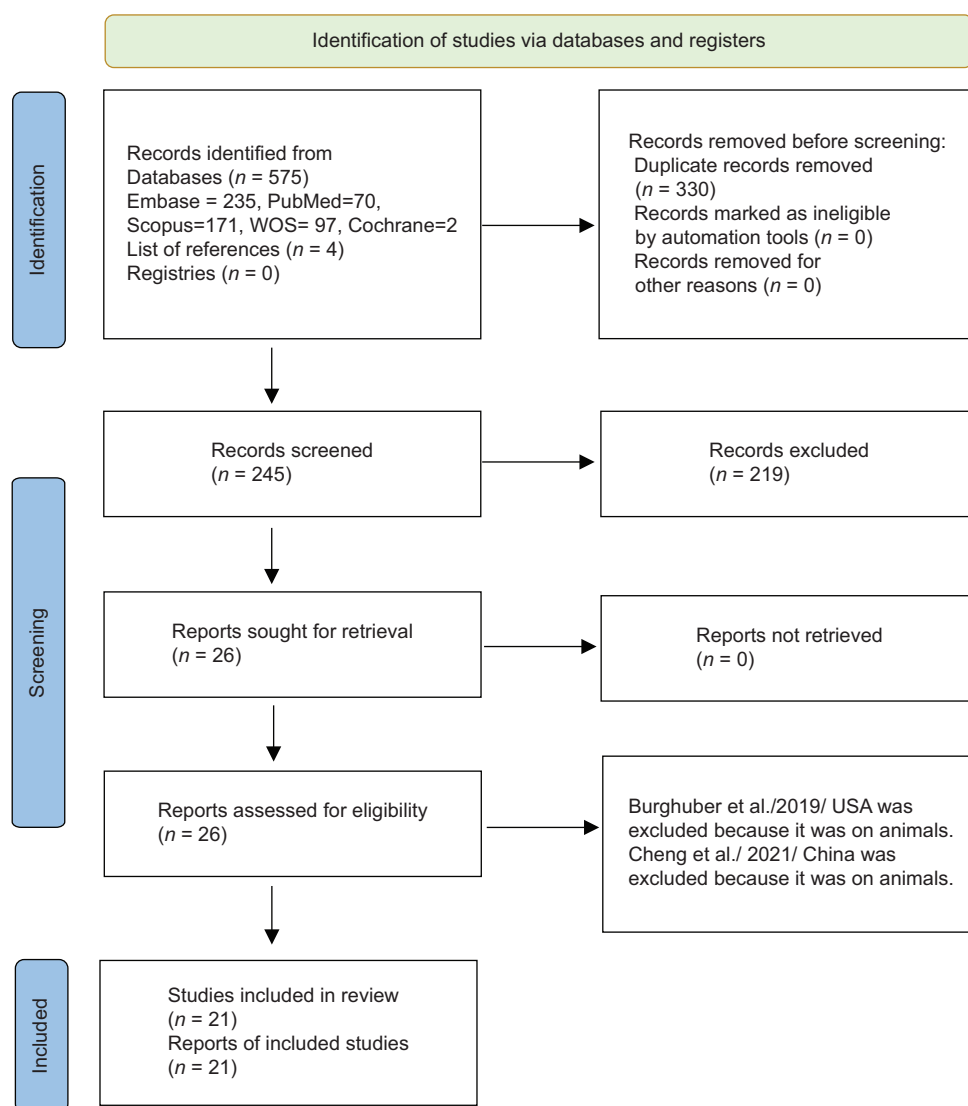


Figure 1: PRISMA flow diagram for the present systematic review

Rejection incidence

In 16 studies (out of 21 studies with clinical data), no incidence of rejection (0%) was reported after treatment with bortezomib. In study by Cicora *et al.*,^[18] acute or mixed rejection was seen in 7 of 8 patients (about 88%), but AMR persisted in the majority of cases. Ejaz *et al.* study reported the 25% incidence of acute rejection at 1 year;^[24] however, other studies have reported no occurrence of AMR or significant reduction in DSA with successful transplantation without rejection.

Safety/tolerability

No significant side effects were reported in about 81% of studies (17 out of 21). In study by Ejaz *et al.* mild neuropathy in 8 of 9 patients (89%), one patient required analgesic medication.^[24] In study by Moreno Gonzales *et al.*, of the 10 patients (20%) had to discontinue treatment due to complications.^[32] In study by Schmidt *et al.*, anemia and neuropathy were reported but were

manageable and of low severity.^[34] Table 2 listed the summary of quantitative results from reviewed studies.

Risk of bias assessment

Due to the predominance of small observational studies, the overall certainty of evidence (GRADE) was rated as low to moderate. Table 3 shows the risk of bias assessment of included papers categorized by research design. Due to a lack of blinding, randomization, and control, the majority of research were case reports or small series, which increases their risk of bias. Moderate-quality evidence exists from a few prospective cohort or open-label trials, although sample numbers remain limited and possible confounders persist. Because of their superior design and bigger sample sizes, Schmidt *et al.*^[34] and Jeong *et al.*^[28] present the lowest risk of bias among the included research. Given the clinical and methodological heterogeneity across studies, meta-analysis was not attempted.

Table 1: Characteristics and summary of extracted data of the included studies

Author/Year/Country	Study Type/ Number of patients	Treatment protocol	Outcomes	Safety/Tolerability
Cicora <i>et al.</i> , 2013 Argentina ^[18]	Case series/8	Various: bortezomib alone, + plasmapheresis, + IVIG, or both	5 AMR, 2 mixed rejections. Moderate DSA reduction; AMR persisted in majority	No adverse effects
Ejaz <i>et al.</i> , 2013 USA ^[24]	Case series/9	rATG±rituximab±bortezomib	Acute rejection: 25% (1 year); 1-year graft survival: 97.5%	Mild neuropathy in 8/9; one required narcotic
Fulchiero <i>et al.</i> , 2024 USA ^[25]	Case series/6	Bortezomib	Four patients had DSA reduction, successful transplant, no rejection	No adverse effects
Ide <i>et al.</i> , 2015 Japan ^[26]	Case series/3	Rituximab + bortezomib + plasmapheresis	All patients had DSA reduction, successful transplant, no rejection	No adverse effects
Inui <i>et al.</i> , 2016 Japan ^[27]	Case report/1	Rituximab → plasmapheresis → IVIG → bortezomib	Gradual DSA decline post-bortezomib, successful transplant, no rejection	No adverse effects
Jeong <i>et al.</i> , 2016 Korea ^[28]	Clinical trial/36	Bortezomib + IVIG + rituximab	Transplant rate: 42% (vs. 24% control). Decreased PRA. No rejection in desensitized group	No adverse effects
Lee <i>et al.</i> , 2022 South Korea ^[29]	Case report/1	Rituximab + plasmapheresis + IVIG±bortezomib posttransplant	Reversal of AMR, sustained graft function for 40 months	No adverse effects
Lonze <i>et al.</i> , 2010 USA ^[30]	Case report/1	Rituximab + IVIG + Eculizumab + bortezomib	Stable function, negative crossmatch at 6 months	No adverse effects
Diwan <i>et al.</i> , 2011 USA ^[31]	Clinical trial/8	Bortezomib±PE	Bortezomib + PE showed better DSA reduction than PE alone	Not reported
Moreno Gonzales <i>et al.</i> , 2017 USA ^[32]	Clinical trial/10	Bortezomib (up to 32 doses unless transplanted)	Modest antibody reduction. Poor tolerability in some	2/10 discontinued due to adverse effects
Oki <i>et al.</i> , 2022 Japan ^[33]	Case report/1	Bortezomib	Reduced proteinuria, slowed PGNMID progression	No adverse effects
Schmidt <i>et al.</i> , 2012 USA ^[34]	Prospective cohort/70	Bortezomib for AMR or desensitization	Toxicities: Anemia (AMR), neuropathy (desensitization), both manageable	Low incidence and severity of adverse events
Park <i>et al.</i> , 2025 Korea ^[35]	Case series/14	Bortezomib	HLA-DSA reduced in 10/14; 93% KT success rate	Not reported
Raghavan <i>et al.</i> , 2009 USA ^[36]	Case report/1	Rituximab + bortezomib	cPRA reduced from 57% to 31%, successful transplant	No adverse effects
Sureshkumar <i>et al.</i> , 2012 USA ^[10]	Case series/2	Bortezomib	DSA and AMR resolved	No adverse effects
Walsh <i>et al.</i> , 2010 USA ^[37]	Case report/2	Rituximab + bortezomib + plasmapheresis	AMR resolved in 14 days; good renal function at 6 months	No adverse effects
Sberro-Soussan <i>et al.</i> , 2010 France ^[23]	Case report/4	Bortezomib	No significant DSA reduction up to 270 days	Stable viral immunity
Tzvetanov <i>et al.</i> , 2012 USA ^[7]	Case report/3	Bortezomib	Early AMR reversed; stable renal function	No adverse effects
Wahrman <i>et al.</i> , 2009 Austria ^[38,39]	Case report/2	Bortezomib + dexamethasone	Modest antibody reduction; C4d-fixing ability declined significantly	No adverse effects
Wong <i>et al.</i> , 2015 Australia ^[40]	Case report/2	Bortezomib + plasmapheresis + IVIG	Reduced anti-A titers; successful crossmatch conversion	No adverse effects
Zhu <i>et al.</i> , 2009 China ^[41]	Case report/1	Bortezomib + plasmapheresis + IVIG	Positive crossmatch turned negative, no rejection, well-tolerated	No adverse effects

DSA=Donor-specific antibodies, AMR=Antibody-mediated rejection, DDKT=Deceased donor kidney transplantation, PGNMID=Proliferative glomerulonephritis with monoclonal immunoglobulin IgG deposits, IVIG=Intravenous immunoglobulin, cPRA=Calculated panel reactive antibody, HLA=Human leukocyte antigen, PE=Plasma exchange

DISCUSSION

The present systematic review encompasses 21 studies with 4 cohort/clinical trials, 6 case series, and 11 case reports, investigating the use of bortezomib alone

or in combination with agents such as rituximab, plasmapheresis, IVIG, and steroids for desensitization or treatment of AMR in kidney transplant candidates or recipients. In terms of desensitization efficacy, most studies demonstrated a reduction in DSAs,

allowing for successful transplantation. Bortezomib was particularly helpful in cases where conventional therapies (e.g., rituximab, IVIG) were insufficient. In terms of AMR management, several reports showed that bortezomib could reverse AMR and help preserve or improve graft function, especially when administered early or in combination with plasmapheresis and steroids. According to our collected results, enhanced

efficacy was often observed when bortezomib was used in combination with rituximab, plasmapheresis, and/or IVIG. Overall, bortezomib was well-tolerated and severe adverse effects were rare. The most common adverse events were mild peripheral neuropathy and anemia, mainly in patients undergoing extended or high-dose regimens. Only in studies reported by Sberro-Soussan *et al.* no improvement was observed with bortezomib and also side effects such as viral immunity was detected.^[17,22,23]

Table 2: Summary of quantitative results from reviewed studies

Outcome	Findings
Graft success rate	≈87% of patients achieved successful transplantation
Rejection-free outcomes	At least 76% of studies (16 out of 21) reported no acute rejection
Adverse events – none reported	≈81% of studies (17 out of 21) reported no major adverse events
Mild/manageable side effects	Ejaz <i>et al.</i> ^[24] : 89% (8/9) had mild neuropathy; 1 needed pain medication
Treatment discontinuation	Moreno Gonzales <i>et al.</i> : 20% (2/10) discontinued due to side effects
Common toxicities	Anemia, neuropathy (Schmidt <i>et al.</i>); overall low incidence/severity

So far, various intensive treatment regimens have been put forward to eliminate anti-HLA Abs against allogeneic HLA in cross-matched positive recipients.^[42] Despite growing evidence that high-dose IVIG has limited utility in reducing HLA antibodies alone, various centers have documented improved outcomes when high-dose IVIG is used in combination with rituximab.^[43] However, extensive clinical experience in many centers has shown a high rate of AMR, especially among highly sensitive patients.^[43] Recently, targeted therapies with plasma cells, especially bortezomib plus rituximab regimens, have shown their efficacy as a very valuable future

Table 3: Overall risk of bias summary

Study	Study type	RoB	Reasoning
Cicora <i>et al.</i> (2013)	Case series (n=8)	High	No control group; small sample; risk of selection and reporting bias
Ejaz <i>et al.</i> (2013)	Case series (n=9)	Moderate	Groups defined; outcome data available; some risk of confounding and selection bias
Ide <i>et al.</i> (2015)	Case series (n=3)	High	Very small size; no comparator; high risk of publication and selection bias
Inui <i>et al.</i> (2016)	Case report (n=1)	High	Descriptive only; high publication bias risk; not generalizable
Jeong <i>et al.</i> (2016)	Prospective open-label trial	Low to moderate	Has control group and statistical adjustment, but open-label design and small sample increase detection and performance bias
Lee <i>et al.</i> (2022)	Case report (n=1)	High	Narrative account; no comparative data; very limited external validity
Lonze <i>et al.</i> (2010)	Case report (n=1)	High	Similar to other case reports: lacks control, randomization, or statistical rigor.
Diwan <i>et al.</i> (2011)	Prospective nonrandomized trial (n=8)	Moderate to high	Control group is historical; small sample; unclear randomization; risk of confounding and bias in outcome measurement
Moreno Gonzales <i>et al.</i> (2017)	Prospective nonrandomized trial (n=10)	Moderate to high	No control group; small sample; dropouts due to adverse events; unclear baseline comparability
Oki <i>et al.</i> (2015)	Case report (n=1)	High	Narrative data; no statistical or comparative assessment
Schmidt <i>et al.</i> (2012)	Prospective cohort (n=70)	Low to moderate	Larger cohort; reasonably detailed; but nonrandomized and susceptible to confounding
Park <i>et al.</i> (2025)	Case series (n=14)	High	No comparator group; observational design; potential reporting bias
Raghavan <i>et al.</i> (2009)	Case report (n=1)	High	Limited generalizability and no comparator
Sureshkumar <i>et al.</i> (2012)	Case series (n=2)	High	Small sample; descriptive data only
Walsh <i>et al.</i> (2010)	Case report (n=2)	High	No comparator or blinding; unclear data collection procedures
Sberro-Soussan <i>et al.</i> (2010)	Case report (n=4)	High	No statistical comparison; subjective reporting
Tzvetanov <i>et al.</i> (2012)	Case report (n=3)	High	Similar limitations to other case reports
Wahrman <i>et al.</i> (2009)	Case report (n=2)	High	No objective blinding or comparator; narrative data
Wong <i>et al.</i> (2015)	Case report (n=2)	High	Lacks control; anecdotal observations
Zhu <i>et al.</i> (2009)	Case report (n=1)	High	No comparison group; high subjectivity and publication bias risk

RoB=Risk of bias

alternative to noninvasive approaches such as IVIG, despite their limited availability.^[36,44]

Although rare, there have been reports of patients experiencing prolonged B-cell dysfunction even after completing rituximab therapy for B-cell lymphomas or autoimmune diseases.^[45] In a study by Wong *et al.*, combination therapy with bortezomib to suppress plasma cell-mediated antibody production, followed by plasmapheresis and low-dose IVIG to eliminate circulating alloantibodies, effectively reduced anti-A titers and converted pretransplant positive B-cell crossmatches to negative. These findings suggest the potential utility of bortezomib as an adjunct to a desensitization regimen in highly sensitized kidney transplant recipients.^[40] Studies by Wahrman *et al.* suggest that bortezomib alone, without concomitant use of other immunosuppressive regimens, has modest activity in reducing circulating anti-HLA antibody or blood group antibody levels in sensitized hemodialysis patients. Nevertheless, the significant reduction in complement-activating antibody activity (C4d-stabilizing) suggests that proteasome inhibition has clinically relevant desensitization potential, namely in reducing antibody-mediated complement activation.^[38,39]

Most evidence is based on case series and case reports, which by definition have a high risk of bias. They are usually uncontrolled, unblinded, and unclassified and are highly susceptible to publication bias, selective outcome reporting, and observer bias. Although they are useful for clinical experience and provide preliminary data on safety, they are also of questionable generalizability and validity. For example, studies such as Inui *et al.*,^[27] Oki *et al.*,^[33] and Raghavan *et al.*^[36] are case series and do not contain comparative or statistically significant data, and are therefore less useful for evidence-based practice. Of the more rigorous designs, a number of prospective clinical trials and cohort studies, for example, Jeong *et al.* (2016)^[28] and Schmidt *et al.* (2012)^[35], showed a moderate risk of bias and had better data. These studies were larger in size and had comparison groups or multivariate analysis, so they were less likely to be confounded. However, they still had problems with issues such as open-label design, nonrandomization, and short-term follow-up that threatened internal validity. The fact that the trials were open-label is also likely to have introduced performance and diagnostic bias, particularly in outcome measures such as graft function and graft rejection rate. Nonprospective, nonrandomized trials, including those by Diwan *et al.*^[31] and Moreno Gonzales *et al.*^[32] attempted to assess treatment outcomes in more structured settings, but they were small and selectively used control groups. Such trials were also limited by

potential selection bias and were not well-reported on dropout rates and baseline characteristics.

In summary, while the accumulating literature suggests that bortezomib may have benefits in reducing DSA titers and treating AMR, the quality of the evidence is still largely low to moderate. The predominance of high-risk, uncontrolled trials highlights the need for well-designed, adequately powered randomized controlled trials to adequately define the efficacy, safety, and optimal use of bortezomib in this setting. In the absence of such information, the use of bortezomib should be based on clinical experience as well as other immunosuppressive therapies on an individual basis.

Limitations

Most studies are small, nonrandomized, and retrospective. Variability in bortezomib dosing (e.g., 1.3 mg/m² on days 1, 4, 8, 11 vs. weekly), administration route, and adjunctive therapies. Lack of standardized outcome definitions (e.g., what constitutes DSA “reduction” varies). Given the clinical and methodological heterogeneity across studies, meta-analysis was not attempted. Long-term graft outcomes are poorly reported. We also acknowledged that limiting to English language may have excluded relevant Asian studies.

CONCLUSION

The collective findings support the potential role of bortezomib as an effective therapeutic option for desensitization and AMR treatment in sensitized kidney transplant patients. While the efficacy appears promising, especially in combination regimens, outcomes vary depending on protocol and patient characteristics. Tolerability is generally favorable, although toxicity may increase with higher cumulative doses. Given the limited sample sizes and heterogeneity in protocols, larger randomized controlled trials are needed to better define the role of bortezomib, optimal dosing, and combination strategies in this setting. Future multi-center randomized trials are essential to define optimal dosing schedules and combination strategies.

AUTHORS' CONTRIBUTIONS

MM and ZI conceived the study idea and developed the study design. MM and RN performed the literature search, data extraction, and quality assessment. ZI and MM drafted the initial manuscript. MM and MaM contributed to statistical analysis, interpretation of findings, and critical revisions of the manuscript. All authors reviewed, edited, and approved the final version of the manuscript. ZI supervised the overall project.

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Conflicts of interest

There are no conflicts of interest.

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APPENDIX

Appendix 1: Search strategy

Embase session results

Number	Query	Results
#10	#3 AND #6 AND #9	235
#9	#7 OR #8	49,548
#8	“desensitizat*”:ti, ab OR “allergen immunotherapy”:ti, ab OR “anti-anaphylax*”:ti, ab OR “antianaphylax*”:ti, ab OR “desensibilisat*”:ti, ab OR “desensibilizat*”:ti, ab OR “hyposensibilisat*”:ti, ab OR “hyposensibilizat*”:ti, ab OR “hyposensitizat*”:ti, ab OR “hyposensitizat*”:ti, ab	39,710
#7	“desensitization”/exp	30,399
#6	#4 OR #5	212,612
#5	“kidney allograft transplant*”:ti, ab OR “kidney allotransplant*”:ti, ab OR “kidney cadaver transplant*”:ti, ab OR “kidney graft*”:ti, ab OR “kidney homotransplant*”:ti, ab OR “kidney retransplant*”:ti, ab OR “renal homotransplant*”:ti, ab OR “kidney transplant*”:ti, ab OR “renal transplant*”:ti, ab	155,811
#4	“kidney transplantation”/exp	198,841
#3	#1 OR #2	43,578
#2	“milatib”:ti, ab OR “mylosome”:ti, ab OR “velcade”:ti, ab OR “bortezomib”:ti, ab	24,613
#1	“bortezomib”/exp	42,185

PubMed

Search	Query	Results
#10	Search: #3 AND #6 AND #9	70
#9	Search: #7 OR #8	36,693
#8	Search: "desensitizat*"[Title/Abstract] OR "allergen immunotherapy"[Title/Abstract] OR "anti-anaphylax*"[Title/Abstract] OR "antianaphylax*"[Title/Abstract] OR "desensibilisat*"[Title/Abstract] OR "desensibilizat*"[Title/Abstract] OR "hyposensibilisat*"[Title/Abstract] OR "hyposensibilizat*"[Title/Abstract] OR "hyposensitizat*"[Title/Abstract] OR "hyposensitizat*"[Title/Abstract] OR "Allergen Immunotherap*"[Title/Abstract] OR "Venom Immunotherap*"[Title/Abstract] OR "Allergy Shot"[Title/Abstract]	29,764
#7	Search: "Desensitization, Immunologic"[Mesh]	12,956
#6	Search: #4 OR #5	130,117
#5	Search: "kidney allograft transplant*"[Title/Abstract] OR "kidney allotransplant*"[Title/Abstract] OR "kidney cadaver transplant*"[Title/Abstract] OR "kidney graft*"[Title/Abstract] OR "kidney homotransplant*"[Title/Abstract] OR "kidney retransplant*"[Title/Abstract] OR "renal homotransplant*"[Title/Abstract] OR "renal transplant*"[Title/Abstract] OR "kidney transplant*"[Title/Abstract] OR "renal transplant*"[Title/Abstract]	96,668
#4	Search: "Kidney Transplantation"[Mesh]	107,834
#3	Search: #1 OR #2	16,191
#2	Search: milatib[tiab] OR mylosome[tiab] OR velcade[tiab] OR bortezomib[tiab] OR "Boronic Acid*"[tiab] "velcade"[Title/Abstract] OR "bortezomib"[Title/Abstract] OR "boronic acid*"[Title/Abstract]	7153

Scopus-results = 171

(TITLE-ABS-KEY (bortezomib OR milatib OR mylosome OR velcade OR bortezomib OR "Boronic Acid*" OR velcade)) AND (TITLE-ABS-KEY ("kidney allograft transplant*" OR "kidney allotransplant*" OR "kidney cadaver transplant*" OR "kidney graft*" OR "kidney homotransplant*" OR "kidney retransplant*" OR "renal homotransplant*" OR "renal transplant*" OR "kidney transplant*" OR "renal transplant*")) AND (TITLE-ABS-KEY ("desensitizat*" OR "allergen immunotherapy" OR "anti-anaphylax*" OR "antianaphylax*" OR "desensibilisat*" OR "desensibilizat*" OR "hyposensibilisat*" OR "hyposensibilizat*" OR "hyposensitizat*" OR "hyposensitizat*" OR "Allergen Immunotherap*" OR "Venom Immunotherap*" OR "Allergy Shot"))

Web of Sciences = 97

Searches	Results
bortezomib OR milatib OR mylosome OR velcade OR bortezomib OR "Boronic Acid*" OR velcade (Topic)	31,069
"kidney allograft transplant*" OR "kidney allotransplant*" OR "kidney cadaver transplant*" OR "kidney graft*" OR "kidney homotransplant*" OR "kidney retransplant*" OR "renal homotransplant*" OR "renal transplant*" OR "kidney transplant*" OR "renal transplant*" (Topic)	135,579
"desensitizat*" OR "allergen immunotherapy" OR "anti-anaphylax*" OR "antianaphylax*" OR OR "desensibilisat*" OR "desensibilizat*" OR "hyposensibilisat*" OR "hyposensibilizat*" OR "hyposensitizat*" OR "hyposensitizat*" OR "Allergen Immunotherap*" OR "Venom Immunotherap*" OR "Allergy Shot" (Topic)	41,441
#1 AND #2 AND #3	97

Cochrane = 2

ID Search	Hits
#1 MeSH descriptor: [Bortezomib] explode all trees	714
#2 (bortezomib OR milatib OR mylosome OR velcade OR bortezomib OR (Boronic NEXT Acid*) OR velcade):ti, ab, kw (Word variations have been searched)	2601
#3 #1 OR #2	2601
#4 MeSH descriptor: [Kidney Transplantation] explode all trees	4713
#5 ((kidney NEXT allograft) OR (kidney NEXT allotransplant*) OR (kidney NEXT transplant*) OR (kidney NEXT graft*) OR (kidney NEXT homotransplant*) OR (kidney NEXT retransplant*) OR (renal NEXT homotransplant*) OR (renal NEXT transplant*) OR (kidney NEXT transplant*) OR (renal NEXT transplant*)):ti, ab, kw (Word variations have been searched)	11,606
#6 #4 OR #5	11,606
#7 (desensitizat* OR (allergen immunotherapy) OR (anti NEXT anaphylax*) OR antianaphylax* OR desensibilisat* OR desensibilizat* OR hyposensibilisat* OR hyposensibilizat* OR hyposensitizat* OR hyposensitizat* OR (Allergen NEXT Immunotherap*) OR (Venom NEXT Immunotherap*) OR "Allergy Shot"):ti, ab, kw (Word variations have been searched)	4958
#8 #3 AND #6 AND #7	2