

3 REVIEW ARTICLE (Systematic Review)

4 Steroid-sparing agents in autoimmune
5 blistering diseases (AIBDs): a systematic
6 review

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11 ABSTRACT

12 **Background:** Long-term corticosteroid use remains central to managing autoimmune blistering diseases
13 (AIBDs) but carries substantial toxicity, prompting wider use of steroid-sparing agents ranging from conven-
14 tional immunosuppressants to biologics. Comparative evidence on the efficacy and safety of these agents
15 remains heterogeneous.

16 **Methods:** We systematically searched PubMed, Web of Science, and Scopus for studies published from 2015
17 to 2025 evaluating steroid-sparing therapies in pemphigus and bullous pemphigoid. After duplicate removal
18 and two-reviewer screening against predefined eligibility criteria, nine studies totaling 396 patients (rand-
19 omized trials, prospective comparisons, and retrospective cohorts) were included. Methodological quality
20 was appraised using ROBINS-I for non-randomized studies and Cochrane RoB2 for randomized trials.

21 **Results:** Rituximab (RTX) was associated with higher long-term remission and faster corticosteroid tapering
22 than conventional immunosuppressants, but with a higher rate of serious adverse events (approximately 15%
23 to 22% vs. 10% to 15%). Short-term dexamethasone-cyclophosphamide pulse therapy performed comparably
24 to RTX in some studies, though its long-term safety remains a concern. Among conventional agents, mycophe-
25 nolate mofetil enabled faster steroid tapering than azathioprine. Risk of bias was moderate to serious across
26 the non-randomized studies and ranged from some concerns to high risk across the three randomized trials;
27 considerable heterogeneity in design and outcome reporting limits direct comparison across studies.

28 **Conclusion:** RTX was associated with more durable disease control than conventional agents in this set of
29 studies, but the certainty of this finding is limited by the moderate-to-high risk of bias and small number of
30 included studies. Treatment selection should be individualized based on disease severity, comorbidities, cost,
31 and access, and future research should prioritize standardized, long-term, pragmatic comparative trials.

32 **Keywords:** Autoimmune Blistering Diseases; Steroid-Sparing Therapy; Immunosuppressive Agents; Rituximab;
33 Pemphigus Vulgaris; Bullous Pemphigoid

34 Introduction

35 Pemphigus refers to a set of autoimmune blistering
36 diseases (AIBDs) where the body's own antibodies attack
37 specific tissues, primarily the skin and the moist linings of
38 the mouth. This attack leads to acantholysis, a breakdown
39 in the connections between skin cells, resulting in painful
40 blisters and raw, eroded areas [1]. Clinicians generally
41 recognize three primary forms of pemphigus: pemphigus
42 vulgaris (PV), pemphigus foliaceus (PF), and bullous
43 pemphigoid (BP) [2]. Among these, PV is by far the

most frequently diagnosed, representing roughly 70% 44
of all pemphigus cases worldwide. Patients with PV can 45

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develop blisters and erosions on the skin and mucous membranes, including those inside the mouth. In contrast, PF is less common, accounting for approximately 20% of cases in regions without endemic forms of the disease. One distinguishing feature of PF is that it typically involves only the skin, sparing the mucous membranes [2,3].

Corticosteroids remain the cornerstone of pemphigus treatment: an initial high-dose regimen brings the disease under control, after which a steroid-sparing agent is typically added to allow tapering [4]. This approach is needed because long-term high-dose corticosteroid use carries real risks, including infection, weight gain, diabetes, and bone and eye damage, which affect quality of life and can make the therapy difficult to sustain [5,6].

Steroid-sparing agents used alongside corticosteroids range from conventional immunosuppressants, azathioprine (AZA), mycophenolate mofetil (MMF), methotrexate (MTX), and dapsone, to regimens such as dexamethasone-cyclophosphamide pulse (DCP) therapy and, more recently, biologics such as rituximab (RTX) [6,7]. AZA and MMF can lower the overall steroid dose needed in PV and BP, though high-quality randomized trials remain scarce and findings have not always been consistent [3]. RTX, a monoclonal antibody targeting CD20-positive B cells, has shown higher remission rates and lower total steroid use than corticosteroids alone in some studies, particularly for moderate-to-severe pemphigus [8], but evidence across agents is drawn from studies that vary widely in design, population, and outcome reporting [9]. This systematic review synthesizes that evidence to clarify the relative efficacy and safety of steroid-sparing agents in AIBDs and to inform clinical decision-making.

Methodology

This systematic review was carried out following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [10].

Literature search strategy

A comprehensive literature search was conducted across PubMed, Web of Science, and Scopus to identify studies published between 2015 and 2025 that evaluated steroid-sparing agents in AIBDs, including pemphigus and BP. In PubMed, a title-based search was performed using (“Pemphigus” OR “Bullous Pemphigoid” OR “Autoimmune Blistering Disease”) combined with (“Steroid-sparing” OR “Immunosuppressive Agents” OR “Biologics” OR “Azathioprine” OR “Mycophenolate” OR “Cyclophosphamide” OR “Methotrexate” OR “Dapsone” OR “Rituximab”), with review articles excluded, yielding 352 non-review records. In Web of Science, an equivalent title search identified 211 records. In Scopus, the same terms yielded 289 records. Gray literature and unpublished studies were not searched. All retrieved citations were exported to reference management software, duplicates were removed, and the remaining studies were screened by title and abstract, followed by full-text assessment against predefined inclusion and exclusion criteria.

Selection of articles and data extraction

Titles and abstracts were independently screened by two reviewers to select relevant studies meeting predefined inclusion criteria. The same reviewers assessed eligibility through full-text screening, with disagreements resolved through consultation with a third reviewer. Data were extracted using a standardized form covering study characteristics (author, year, design, country, sample size, age, gender distribution, disease type, disease duration, disease severity, newly diagnosed vs. refractory status, previous systemic treatments), intervention details, and efficacy and safety outcomes.

Eligibility criteria

Studies were included if they: (1) included patients diagnosed with AIBDs such as PV, PF, or BP; (2) assessed steroid-sparing treatments including RTX, AZA, MMF, cyclophosphamide, MTX, dapsone, or similar regimens; (3) reported clinical outcomes concerning efficacy or steroid-sparing effects; and (4) were randomized controlled trials (RCTs), cohort studies, or comparative observational studies published from 2015 to 2025. Studies were excluded if they consisted of case reports, small case series, narrative or systematic reviews, editorials, or conference abstracts without full texts. Only studies published in English were included.

Outcomes of interest

The main outcomes studied were reduction in corticosteroid dose, time needed to taper or stop steroids, and rates of complete or sustained remission. Secondary outcomes included relapse rates, time until relapse, and the occurrence of adverse and serious adverse events (SAEs). These outcomes were determined prior to study selection.

Quality assessment

The ROBINS-I tool was used to evaluate the quality of non-randomized studies included in this review [11]. This established method is designed for appraising studies of interventions that lack randomization, focusing on how well they approximate a fair comparison, and examines potential distortions across seven domains, from participant selection to outcome measurement and reporting. The Cochrane risk-of-bias tool for randomized trials (RoB2) was used to evaluate methodological quality across five domains: (1) randomization process, (2) deviations from intended interventions, (3) missing outcome data, (4) measurement of the outcome, and (5) selection of the reported result [12].

The review protocol was not registered in the International Prospective Register of Systematic Reviews (PROSPERO).

Results

Study selection (PRISMA)

Eight hundred fifty-two records were retrieved from three databases during the identification process (PubMed,

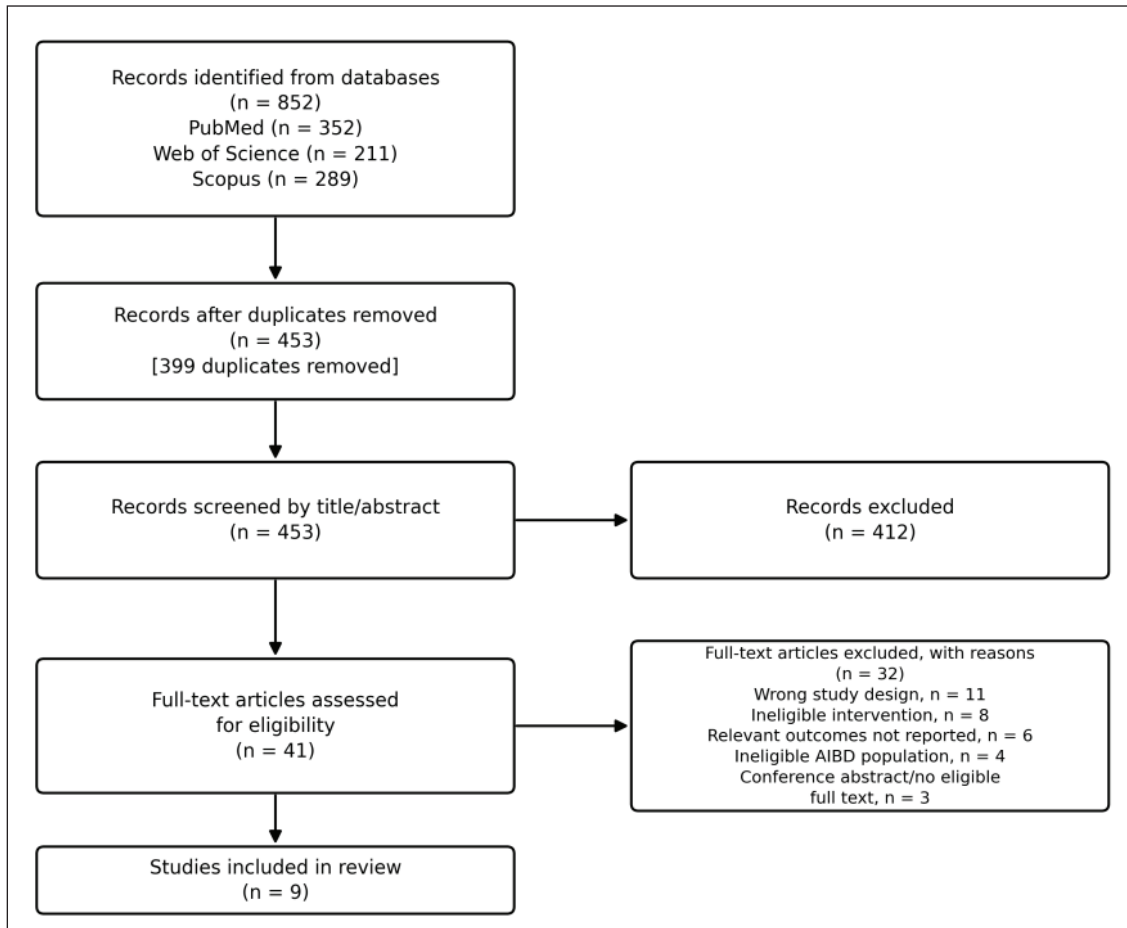


Figure 1. PRISMA 2020 flow diagram of study identification and inclusion.

Table 1. Baseline characteristics of the included studies.

First author, year	Study design, country	Sample size	Disease type	Disease severity/duration	Newly diagnosed vs. refractory
Khandpur et al., 2024 [13]	Prospective, non-randomized, comparative pilot study, India	37 (A: 22, B: 15)	PV	%BSA: A 6% (2–20); B 4% (1–30); duration A 6 mo, B 13 month	All refractory/persistent
Das et al., 2021 [14]	Retrospective comparative study, India	12 (6/6)	PV	Moderate–severe (PAAS); duration ~8 month both groups	NR
Werth et al., 2021 [15]	International RCT, multicenter, double-blind	135 (67/68); mITT 125	PV	PDAI: RTX 22.7, MMF 18.3; 83% moderate, 15% severe	Newly diagnosed 74%; established 26%
Sinha et al., 2020 [16]	Retrospective comparative study, India	14 (7/7)	PV	Mean PDAI 45.21±15.23	42.9% new; 57.1% refractory
Sukanjanapong et al., 2020 [17]	Retrospective cohort study, Thailand	62 (AZA 37, MMF 25)	PV 44, PF 18	Baseline ABSIS: AZA 4.5, MMF 4	56.5% new; 32.3% partially treated; 11.3% relapse
Iraji et al., 2019 [18]	Double-blind RCT, Iran	21	PV	PVLSS, baseline varied; duration 8 months–10 years	Refractory (≥4 mo unresponsive)
Agarwal et al., 2018 [19]	Retrospective comparative study, USA	40	PV	PDAI median 15 (10–39.5)	Refractory (32.5% failed conventional therapy)
Sticherling et al., 2017 [20]	Prospective, multicenter RCT, non-blinded, Germany/Austria	54	BP	Skin involvement: 52% >20% BSA	Newly diagnosed/untreated
Sardana et al., 2016 [21]	Prospective, non-randomized pragmatic trial, India	21	PV	Cutaneous severe 60.9%; mucosal severe 54.2%	Newly diagnosed/treatment-naïve

Abbreviations: ABSIS: Autoimmune Bullous Skin Disorder Intensity Score; AZA: Azathioprine; BP: Bullous Pemphigoid; BSA: Body Surface Area; DCP: Dexamethasone-Cyclophosphamide Pulse; MMF: Mycophenolate Mofetil; mITT: modified Intention-to-Treat; NR: Not Reported; PAAS: Pemphigus Area and Activity Score; PDAI: Pemphigus Disease Area Index; PF: Pemphigus Foliaceus; PV: Pemphigus Vulgaris; PVLSS: Pemphigus Vulgaris Lesion Severity Score; RCT: Randomized Controlled Trial; RTX: Rituximab; SD: Standard Deviation.

Table 2. Intervention (Steroid-Sparing Agent) details.

First author, year	Agent(s)/drug class	Dose summary	Duration	Concomitant steroid
Khandpur et al., 2024 [13]	DCP+cyclophosphamide versus RTX+cyclophosphamide	A: dexamethasone/cyclophosphamide IV pulses; B: rituximab IV (RA protocol) + oral cyclophosphamide	32 wk (A); 2 infusions + 1 year oral cyclophosphamide (B)	Yes, both (oral prednisolone)
Das et al., 2021 [14]	RTX versus DCP	RTX 1g IV d1 and d15; DCP dexamethasone/cyclophosphamide monthly pulses	2 infusions/monthly pulses, 9-month follow-up	Yes, both groups
Werth et al., 2021 [15]	RTX versus MMF	RTX 1000mg IV d1,15,168,182; MMF 1–2g/day oral	52 weeks	Yes (tapered to 0 by week24)
Sinha et al., 2020 [16]	DCP versus RTX	DCP monthly IV pulses; RTX 1000mg IV ×2, 15 d apart	18-month follow-up	Yes (some patients)
Sukanjanapong et al., 2020 [17]	AZA versus MMF	AZA 0.83→1.41 mg/kg/day; MMF 910→1530 mg/day, oral	Median: AZA 595 days; MMF 399 days	Yes, both (with prednisolone)
Iraji et al., 2019 [18]	RTX versus triamcinolone	10 mg/mL per lesion, intralesional × 2, 1 month apart	1 month; assessed at 1 & 6 month	Yes (concurrent prednisolone + AZA)
Agarwal et al., 2018 [19]	RTX	1g/infusion × 2 cycles, 14 d apart	Not fixed; median follow-up 47.5 months	Yes (concomitant prednisone)
Sticherling et al., 2017 [20]	AZA versus Dapsone	AZA 1.5–2.5 mg/kg/day; Dapsone 1.5 mg/kg/day, oral	12 months total observation	Yes (methylprednisolone, tapered)
Sardana et al., 2016 [21]	AZA versus cyclophosphamide	AZA 1–1.5 mg/kg/day; cyclophosphamide 1–1.5 mg/kg/day, oral	6-month study + 6-month maintenance	Yes (oral prednisolone)

Abbreviations: AZA: Azathioprine; DCP: Dexamethasone-Cyclophosphamide Pulse; IV: Intravenous; MMF: Mycophenolate Mofetil; RA: Rheumatoid Arthritis (dosing protocol); RTX: Rituximab. Full dosing schedules and routes of administration are provided in Supplementary Table S2.

Table 3. Outcomes of steroid-sparing effect.

First author, year	Reduction in corticosteroid dose	Time to minimal therapy/discontinuation	Proportion achieving steroid-free remission	Cumulative steroid dose during follow-up
Khandpur et al., 2024 [13]	NR	Median 2 months to disease control	NR	Group A median 2222.5mg (0–5,750); Group B median 2325mg (0–10,095)
Das et al., 2021 [14]	NR	G1: steroids stopped by 3 months (6/6); G2: continued 6 mo (6/6)	G1: 100% (6/6) by 3 months; G2: 100% (6/6) by 6 months	NR
Werth et al., 2021 [15]	NR	Discontinued by week 24	RTX 40% (25/62); MMF 10% (6/63) sustained complete remission	RTX mean 3,545 mg/52weeks; MMF mean 5,140 mg/52weeks
Sinha et al., 2020 [16]	NR	NR	NR	NR
Sukanjanapong et al., 2020 [17]	NR	NR	AZA 24.3% (9/37); MMF 20% (5/25) CR off therapy	AZA: median 7740mg (CR on therapy)/mean 12,857.3mg (CR off therapy). MMF: median 3473.8mg (on) / mean 7590.5mg (off)
Iraji et al., 2019 [18]	NR	NR	NR	NR
Agarwal et al., 2018 [19]	RTX group: prednisone 658.57→177.22 mg/month (73% reduction, $p = 0.002$)	RTX median 14.31 months (IQR 10–22.29); CAT-only median 11.04 months (IQR 7.23–16.33), NS ($p = 0.38$)	RTX 62% (8/13); CAT-only 63% (17/27) discontinued prednisone	NR
Sticherling et al., 2017 [20]	AZA: median cumulative methylprednisolone 2.65g (IQR 2.12–4.05). Dapsone: 1.92g (IQR 1.05–3.33)	AZA median 251 d (IQR 220–345) to CR off therapy (5/27); Dapsone median 81 days (3/27)	AZA “complete remission off therapy” 1/27 at 12 months; Dapsone 4/27	AZA 2.65g/148days; Dapsone 1.92g/51d of application
Sardana et al., 2016 [21]	AZA: mean cumulative prednisolone 920.25mg/6months; Cyclophosphamide: 880.34mg/6months (NS between groups)	NR	NR	See reduction column

Abbreviations: AZA: Azathioprine; CAT: Conventional Adjuvant Therapy; CR: Complete Remission; IQR: Interquartile Range; MMF: Mycophenolate Mofetil; NR: Not Reported; NS: Not Significant.

ofSAEs with RTX across several of the included studies may relate to its mechanism, since it depletes B cells and raises infection risk; its use in more severe or refractory cases in these cohorts may also play a role.

Sinha et al. (2020) found comparable long-term efficacy between RTX and DCP therapy in a cohort of 14 PV patients; both treatments achieved significant and similar reductions in disease severity scores over 18 months,

	Risk of bias domains							Overall
	D1	D2	D3	D4	D5	D6	D7	
Study								
Khandpur et al., 2024	⊗	-	-	-	-	-	+	⊗
Das et al., 2021	⊗	⊗	-	-	-	-	+	⊗
Sinha et al., 2020	⊗	⊗	+	-	-	-	+	⊗
Sukanjanapong et al, 2020	-	-	+	-	-	-	+	-
Agarwal et al., 2018	⊗	-	+	-	-	-	+	⊗
Sardana et al., 2016	⊗	-	+	-	-	-	+	⊗

Domains:
D1: Bias due to confounding.
D2: Bias due to selection of participants.
D3: Bias in classification of interventions.
D4: Bias due to deviations from intended interventions.
D5: Bias due to missing data.
D6: Bias in measurement of outcomes.
D7: Bias in selection of the reported result.

Judgement
⊗ Serious
- Moderate
+ Low

Figure 2. ROBINS-I risk-of-bias assessment of the non-randomized included studies.

	Risk of bias domains					Overall
	D1	D2	D3	D4	D5	
Study						
Werth et al., 2021	+	-	-	+	+	-
Iraji et al., 2019	-	+	-	+	-	-
Sticherling et al., 2017	-	⊗	-	-	-	⊗

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

Judgement
⊗ High
- Some concerns
+ Low

Figure 3. RoB2 risk-of-bias assessment of the three included RCTs.

though RTX showed a non-significant trend toward faster remission. Two patients in the DCP group discontinued cyclophosphamide due to adverse events, leading to subsequent relapse, while no major side effects were reported with RTX [16].

Among conventional agents, Sukanjanapong et al. found that MMF achieved complete remission nearly 5 months faster on average than AZA and required less cumulative steroid exposure [17], suggesting the choice of immunosuppressant matters even outside the biologic-versus-conventional comparison [16,21]. Cost and accessibility remain practical limits on this decision: RTX's availability and affordability vary, particularly in low- and middle-income countries. Most of the included evidence for RTX is specific to PV rather than BP, where the evidence base for steroid-sparing biologics is more limited and conventional agents remain the more established option.

Iraji et al. compared intralesional RTX with triamcinolone for refractory oral and scalp lesions in

PV patients already on systemic prednisolone and AZA; both treatments significantly reduced lesion size and improved patient satisfaction over six months, with no statistically significant difference in efficacy, suggesting intralesional RTX is a viable alternative to intralesional corticosteroids for localized, resistant lesions [18]. In refractory PV, Agarwal et al. found that introducing RTX was associated with a 73% reduction in prednisone dose, supporting earlier consideration of its use in appropriately selected patients [19].

Optimizing steroid-sparing strategies in AIBDs means balancing aggressive disease control against patient well-being. The agents reviewed here, from conventional immunosuppressants to targeted biologics, each carry different trade-offs in efficacy, safety, and practicality. RTX shows strong steroid-sparing effects, but treatment still needs to be tailored to disease severity, comorbidities, and access to therapy. More pragmatic, well-designed studies with real-world outcomes would give clinicians more confidence when choosing between these options.

Table 4. Clinical efficacy and safety outcomes.

First author, year	Overall remission	Relapse rate	Serious adverse events (SAEs)	Mortality	Conclusion
Khandpur et al., 2024 [13]	A: 73% (16/22); B: 93% (14/15)	A: 27% (4/15); B: 50% (7/14)	A: 3 events (2 deaths, 1 hospitalization); B: 4 events (1 death, 3 hospitalizations)	A: 2 deaths (9%); B: 1 death (6.7%)	DCP has clinical efficacy comparable to RTX
Das et al., 2021 [14]	100%	G1: 0%; G2: 33.3%	G1: 1 (16.6%) infusion reaction; G2: 3 (50%) weakness/cushingoid facies/ oligomenorrhea	None	RTX superior to DCP as first-line therapy for PV in India
Werth et al., 2021 [15]	RTX 40%; MMF 10% sustained CR	RTX 6 flares/52wk; MMF 44 flares/52wk	RTX 22% (15/67); MMF 15% (10/68) [safety population]	MMF: 1 death (lung cancer)	RTX improved remission/ steroid reduction vs MMF but more SAEs
Sinha et al., 2020 [16]	Both groups: all 7 patients achieved remission	DCP: 28.6% (2/7)	NR	NR	DCP and RTX comparable in inducing/maintaining remission
Sukanjanapong et al., 2020 [17]	AZA CR-on-therapy 73%; MMF 72%	AZA 13.3%; MMF 6.7%	AZA: hepatitis, meningitis, TB, marrow suppression; MMF: hepatitis, pneumonia, cellulitis+DVT	None	MMF achieves CR faster with greater steroid-sparing effect
Iraji et al., 2019 [18]	Both RTX and triamcinolone effective	RTX: 2 patients	None	NR	Intralesional RTX viable alternative to triamcinolone
Agarwal et al., 2018 [19]	RTX 100% ≥PR; CAT-only 96% ≥PR	NR	NR	NR	RTX reduced prednisone by 73%, supports earlier use
Sticherling et al., 2017 [20]	AZA 70% CR at 12months; Dapsone 65% CR at 12mo	2/27 in both groups	AZA: 3 deaths (pneumonia, carcinoma, unknown); Dapsone: 1 death (hepatic/renal/cardiac)	AZA 11% (3/27); Dapsone 4% (1/27)	Dapsone showed greater steroid-sparing potential than AZA
Sardana et al., 2016 [21]	Progressive clinical improvement in most patients	NR	Cyclophosphamide: myocarditis/cardiac arrest (1st month)	Cyclophosphamide: 2/10 (20%)	AZA and cyclophosphamide similar efficacy at 6 months

Abbreviations: AZA: Azathioprine; CAT: Conventional Adjuvant Therapy; CR: Complete Remission; DCP: Dexamethasone-Cyclophosphamide Pulse; DVT: Deep Vein Thrombosis; MMF: Mycophenolate Mofetil; NR: Not Reported; PR: Partial Remission; PV: Pemphigus Vulgaris; RTX: Rituximab; SAEs: Serious Adverse Events; TB: Tuberculosis.

Treatment selection should therefore be individualized according to disease severity, prior treatment response, comorbidities, safety considerations, and access to therapy.

Limitations

This systematic review has several limitations. The number of included studies is small and their designs, patient populations, and outcome definitions vary considerably, which limits generalizability and direct comparison. Most non-randomized studies were judged at serious risk of bias, chiefly from confounding and selection bias (Supplementary Table S3), and one of the three randomized trials was judged at high risk of bias (Supplementary Table S4); together, this means the comparative findings, particularly the apparent advantage of RTX, should be read as hypothesis-generating rather than conclusive. Relapse and mortality figures in Table 4 also use denominators that differ across studies (responders versus full treatment groups), which further limits direct comparison. Most evidence came from a small number of countries, limiting broader applicability. The review protocol was not registered in PROSPERO. Even so, the review offers a structured comparison of the available evidence and points to specific areas, larger randomized trials with standardized outcome definitions and denominators, where future research is needed.

Conclusion

This systematic review synthesizes current evidence on steroid-sparing agents for AIBDs. Across the nine included studies, RTX was associated with more durable disease control, higher remission, and reduced steroid dependence than conventional agents, particularly in moderate-to-severe PV, but this association came with a higher rate of SAEs and should not be read as proof of superiority given the moderate-to-high risk of bias and small number of studies. Conventional agents such as MMF and AZA remain reasonable options, with more familiar long-term tolerability data. No single agent was clearly best across all the studies reviewed; the choice depends on disease severity, treatment history, comorbidities, and accessibility. These findings should be interpreted cautiously given the risk of bias and heterogeneity of the included studies, which point to the need for more standardized, pragmatic trials with patient-centered outcomes.

List of Abbreviations

AIBD	Autoimmune Blistering Disease
AZA	Azathioprine
BP	Bullous Pemphigoid
CR	Complete Remission
DCP	Dexamethasone-Cyclophosphamide Pulse
MMF	Mycophenolate Mofetil
MTX	Methotrexate
PAAS	Pemphigus Area and Activity Score

377	PDAI	Pemphigus Disease Area Index	6.	Zeng FA, Wilson A, Sheriff T, Murrell DF. Side effects of steroid-sparing agents in patients with bullous pemphigoid and pemphigus: a systematic review. JAAD Int. 2022;9:33–43. https://doi.org/10.1016/j.jdin.2022.07.005	435 436 437 438 439
378	PF	Pemphigus Foliaceus	7.	Harman KE, Brown D, Exton LS, Groves RW, Hampton PJ, Mohd Mustapa MF, et al. British Association of Dermatologists' guidelines for the management of pemphigus vulgaris 2017. Br J Dermatol. 2017;177(5):1170–201. https://doi.org/10.1111/bjd.15930	440 441 442 443 444
379	PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses	8.	Chen DM, Oduyungbo A, Csinady E, Gearhart L, Lehane P, Cheu M, et al. French study group on autoimmune bullous diseases. Rituximab is an effective treatment in patients with pemphigus vulgaris and demonstrates a steroid-sparing effect. Br J Dermatol. 2020;182(5):1111–9. https://doi.org/10.1111/bjd.18482	445 446 447 448 449 450
380			9.	Zhao W, Wang J, Zhu H, Pan M. Comparison of guidelines for management of pemphigus: a review of systemic corticosteroids, rituximab, and other immunosuppressive therapies. Clin Rev Allergy Immunol. 2021;61(3):351–62. https://doi.org/10.1007/s12016-021-08882-1	451 452 453 454 455
381	PROSPERO	International Prospective Register of Systematic Reviews	10.	Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372(71):n71. https://doi.org/10.1136/bmj.n71	456 457 458 459
382			11.	Sterne JA, Hernán MA, Reeves BC, Savović J, Berkman ND, Viswanathan M, et al. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. BMJ. 2016;355:i4919 https://doi.org/10.1136/bmj.i4919	460 461 462 463
383	PV	Pemphigus Vulgaris	12.	Sterne JA, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019;366:l4898. https://doi.org/10.1136/bmj.l4898	464 465 466 467
384	RCT	Randomized Controlled Trial	13.	Khandpur S, Sharma P, Sharma VK, Das D, Sharma A, Bhari N, et al. Comparison of the clinical efficacy of rituximab infusion and dexamethasone-cyclophosphamide pulse therapy and their effect on serum Th1, Th2, and Th17 cytokines in pemphigus vulgaris-a prospective, nonrandomized, comparative pilot study. Indian Dermatol Online J. 2024;15(3):464–72. https://doi.org/10.4103/idoj.idoj_558_23	468 469 470 471 472 473 474 475
385	RoB2	Cochrane Risk-of-Bias tool for randomized trials, version 2	14.	Das S, Agarwal K, Singh S, Halder D, Sinha S, De A. A comparative study to evaluate the efficacy and cost of rituximab versus dexamethasone cyclophosphamide pulse in patients of pemphigus vulgaris. Indian J Dermatol. 2021;66(2):223. https://doi.org/10.4103/ijid.IJD_306_20	476 477 478 479 480
386			15.	Werth VP, Joly P, Mimouni D, Maverakis E, Caux F, Lehane P, et al. PEMPHIX Study Group. Rituximab versus mycophenolate mofetil in patients with pemphigus vulgaris. N Engl J Med. 2021;384(24):2295–305. https://doi.org/10.1056/NEJMoa2028564	481 482 483 484 485
387	ROBINS-I	Risk of Bias in Non-randomised Studies of Interventions	16.	Sinha P, Oberoi B, Yadav AK, Pathania V, Tripathy DM. Comparative retrospective evaluation of efficacy of rituximab therapy with dexamethasone cyclophosphamide pulse therapy in patients of pemphigus vulgaris at a tertiary care hospital. Med J DY Patil Univ. 2020;13(2):120–4. https://doi.org/10.4103/mjdrdypu.mjdrdypu_100_19	486 487 488 489 490 491 492
388			17.	Sukanjanapong S, Thongtan D, Kanokrunge S, Suchonwanit P, Chanprapaph K. A comparison of azathioprine and mycophenolate mofetil as adjuvant drugs in patients with pemphigus: a retrospective cohort study. Dermatol Ther (Heidelb). 2020;10(1):179–89. https://doi.org/10.1007/s13555-019-00346-x	493 494 495 496 497 498 499
389	RTX	Rituximab			
390	SAE	Serious Adverse Event			
391	Conflicts of interest				
392	The authors declare that there is no conflict of interest regarding the publication of this article.				
393					
394	Funding				
395	This research received no external funding.				
396	Data availability				
397	All data extracted and analyzed for this review are available within the article and its tables. Search strategies for each database are reported in the Methodology section.				
398					
399					
400	Ethical approval				
401	As this is a systematic review of previously published, de-identified data and did not involve direct enrolment of human participants, formal institutional ethics committee approval was not required.				
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