Oral Janus kinase inhibitor switching in alopecia areata: a systematic review and meta-analysis

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Reproducibility Materials

1. Extended Methods

This systematic review and meta-analysis was conducted according to PRISMA 2020 recommendations. The protocol was registered in PROSPERO (CRD420261362920). A systematic literature search was conducted in PubMed/MEDLINE, Embase (via Ovid), and Scopus from database inception to 10 April 2026 to identify studies reporting outcomes after switching between oral JAK inhibitors in patients with AA. The search strategy combined terms for alopecia areata, oral JAK inhibitors, and treatment switching or sequencing. No limits were imposed on language, publication year, or study design. Also, the reference lists of included studies were screened manually.

We included original studies reporting clinical outcomes after switching from one oral JAK inhibitor to another in patients with AA. Eligible designs included retrospective cohorts, prospective cohorts, case series, and datasets derived from clinical trials, provided that post-switch efficacy data could be extracted.

We excluded studies without extractable post-switch efficacy outcomes and studies in which switching was only mentioned without analyzable data. When cohort overlap was suspected, only one representative dataset was retained for quantitative synthesis; overlapping reports were retained for qualitative synthesis.

Title and abstract screening was performed independently by two authors (JT and GC) in Rayyan, followed by full-text review for final eligibility. Disagreements were resolved by discussion and consensus.

1.1 Search Strategy

1.1.1 PubMed/MEDLINE

Search performed from inception to the 10th of April 2026.

The following search strategy was used for PubMed/MEDLINE:

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(
  "alopecia areata"[Title/Abstract]
  OR "alopecia totalis"[Title/Abstract]
  OR "alopecia universalis"[Title/Abstract]
)
AND
(
  "janus kinase inhibitor"[Title/Abstract]
  OR "janus kinase inhibitors"[Title/Abstract]
  OR "JAK inhibitor"[Title/Abstract]
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 OR "JAK inhibitors"[Title/Abstract]
 OR tofacitinib[Title/Abstract]
 OR baricitinib[Title/Abstract]
 OR ritlecitinib[Title/Abstract]
 OR deuruxolitinib[Title/Abstract]
 OR ruxolitinib[Title/Abstract]
 OR upadacitinib[Title/Abstract]
 OR abrocitinib[Title/Abstract]
 OR brepocitinib[Title/Abstract]
)
AND
(
 switch[Title/Abstract]
 OR switching[Title/Abstract]
 OR switched[Title/Abstract]
 OR sequence[Title/Abstract]
 OR sequencing[Title/Abstract]
 OR refractory[Title/Abstract]
 OR "treatment failure"[Title/Abstract]
 OR failed[Title/Abstract]
 OR failure[Title/Abstract]
 OR "inadequate response"[Title/Abstract]
 OR "loss of response"[Title/Abstract]
 OR "previously treated"[Title/Abstract]
 OR "prior JAK"[Title/Abstract]
 OR "previous JAK"[Title/Abstract]
 OR "JAK-experienced"[Title/Abstract]
 OR intolerance[Title/Abstract]
 OR intolerant[Title/Abstract]
 OR "adverse event"[Title/Abstract]
 OR "adverse events"[Title/Abstract]
 OR discontinuation[Title/Abstract]
```

OR discontinued[Title/Abstract]

OR insurance[Title/Abstract]

OR access[Title/Abstract]

)

1.1.2 Embase (Ovid)

Search performed from inception to the 10th of April 2026.

The following search strategy was used for Embase (Ovid):

1. (alopecia areata or alopecia totalis or alopecia universalis).ti,ab.

2. (janus kinase inhibitor* or JAK inhibitor* or tofacitinib or baricitinib or ritlecitinib or deuruxolitinib or ruxolitinib or upadacitinib or abrocitinib or brepocitinib).ti,ab.

3. (switch* or sequenc* or refractory or "treatment failure" or failed or failure or "inadequate response" or "loss of response" or "previously treated" or "prior JAK" or "previous JAK" or "JAK-experienced" or intoleran* or "adverse event*" or discontinu* or insurance or access).ti,ab.

4. 1 and 2 and 3

1.1.3 Scopus

Search performed from inception to the 10th of April 2026.

The following search strategy was used for Scopus:

TITLE-ABS-KEY(

("alopecia areata" OR "alopecia totalis" OR "alopecia universalis")

AND

("janus kinase inhibitor*" OR "JAK inhibitor*" OR tofacitinib OR baricitinib OR ritlecitinib OR deuruxolitinib OR ruxolitinib OR upadacitinib OR abrocitinib OR brepocitinib)

AND

(switch* OR sequenc* OR refractory OR "treatment failure" OR failed OR failure OR "inadequate response" OR "loss of response" OR "previously treated" OR "prior JAK" OR "previous JAK" OR "JAK-experienced" OR intoleran* OR "adverse event*" OR discontinu* OR insurance OR access)

)

1.2 Data extraction and study coding

Data were extracted into a standardized case report form. For each eligible study, we recorded first author, year, journal, study design, switch direction, cohort size, follow-up timepoint, and reported efficacy outcomes. Study populations were classified as adolescent-to-adult (≥12 years of age), pediatric (<12 years), or mixed.

1.3 Definition of switch baseline, follow-up, and outcomes

For all switch-specific efficacy analyses, the switch baseline was defined as the disease severity assessment obtained immediately before initiation of the second JAK inhibitor. Measures obtained before the first JAK inhibitor were considered contextual and were not used as the anchor for the main analysis. When more than one post-switch assessment was available, one timepoint per cohort was selected according to a prespecified hierarchy centered on approximately 24 weeks after switching. When week 24 was unavailable, the closest approximate 24-week or 6-month assessment was selected. If neither was available, later assessments or most recent variable follow-up values were used, depending on data availability.

The primary binary outcome was achievement of a Severity of Alopecia Tool (SALT) score of 20 or less after switching. The secondary binary outcome was achievement of SALT of 10 or less. Relative response thresholds, including SALT30, SALT50, SALT75, SALT80, SALT90, and SALT100, were extracted but synthesized descriptively because of heterogeneity in reporting definitions and timepoints.

Mean change in SALT score from switch baseline to the selected post-switch follow-up was also recorded. Mean change was calculated as the difference between pre-switch and post-switch means, and its standard deviation was derived assuming a within-subject correlation coefficient of 0.50. For studies reporting medians and interquartile ranges instead of means and standard deviations, summary measures were converted using a prespecified approximation. The mean was estimated as the average of the first quartile, median, and third quartile, and the standard deviation was estimated as the interquartile range divided by 1.35.

When outcome data were not tabulated but individual data were available, paired values were manually reconstructed to calculate pre-switch means and post-switch means.

1.4 Statistical analysis and methodological quality appraisal

Binary outcomes were pooled using random-effects meta-analyses of proportions. For the primary synthesis, we estimated the pooled proportion of patients achieving SALT ≤20 after switching. The same approach was applied to the secondary SALT ≤10 threshold. Proportions were pooled using a logit transformation, and results were back-transformed and expressed as percentages with 95% confidence intervals. Between-study heterogeneity was quantified using I^2 and τ^2, and prediction intervals were calculated when appropriate.

Continuous outcomes were pooled using random-effects meta-analysis of mean SALT reduction from switch baseline. Mean change was defined so that positive values indicated improvement after switching. Study-specific standard errors were derived from the corresponding SD of change and sample size. Between-study variance was estimated using restricted maximum likelihood.

Sensitivity analyses were performed to assess the robustness of the main findings. For the primary binary endpoint, these included restriction to exact or approximate 24-week post-switch assessments, exclusion of very small cohorts or case-series-level evidence (n ≤10), and leave-one-out influence analysis. For the continuous outcome, sensitivity analyses included exclusion of estimates based on median-to-mean conversion or figure-derived summary data, as well as leave-one-out influence analysis. Small-study effects for the primary binary outcome were explored visually using funnel plot inspection and statistically using Egger's regression test.

Methodological quality was assessed using the Joanna Briggs Institute Critical Appraisal Checklist for Case Series for uncontrolled observational switching cohorts. Certainty of evidence for the main pooled outcomes was assessed using the GRADE approach.

Supplementary Table S1

Binary outcome extraction for SALT≤10

SALT≤10 indicates ≤10% scalp hair loss after switching. Percentages were calculated using the denominator available for the selected cohort and follow-up. JAKi, Janus kinase inhibitor; SALT, Severity of Alopecia Tool.

Study	Design	Population included	Switch direction	Follow-up	SALT≤10, n/N (%)
Chen 2025	Single-center Retrospective observational	Adults/adolescents	Baricitinib to ritlecitinib	24 weeks	6/15 (40.0)
Huang 2025	Single-center Retrospective observational	Adults/adolescents	Prior JAKi to ritlecitinib	24 weeks	8/17 (47.1)
Martin 2026	Multicenter Retrospective observational	Mixed	Mixed oral JAKi to oral JAKi	Variable	28/86 (32.6)
Muñoz-Barba 2025	Single-center Prospective observational	Adults/adolescents	Tofacitinib to baricitinib	24 weeks	6/10 (60.0)
Silva 2025	Single-center Retrospective observational	Adults/adolescents	Baricitinib to ritlecitinib	Variable	2/15 (13.3)
Hayashi 2026	Single-center Retrospective observational	Adults/adolescents	Baricitinib to ritlecitinib	24 weeks	0/8 (0.0)

Supplementary Table S2

Relative threshold outcomes

Relative SALT response thresholds after switching between oral JAK inhibitors. SALT30/50/75/80/90/100 indicate ≥30%, ≥50%, ≥75%, ≥80%, ≥90%, and 100% improvement from baseline or pre-switch SALT, as reported in each study.

Study	Year	Switch direction	N	Follow-up	Outcome	n/N (%)
Chen et al.	2025	Baricitinib to ritlecitinib	15	Week 24	SALT50	9/15 (60.0)
					SALT75	9/15 (60.0)
					SALT80	9/15 (60.0)
					SALT90	4/15 (26.7)
Huang et al.	2025	Prior JAK to ritlecitinib	18	Week 24	SALT30	13/17 (76.5)
					SALT50	10/17 (58.8)
					SALT80	6/17 (35.3)
Kazmi et al.	2023	Mixed	77	Variable	SALT100	35/77 (45.5)
Martin et al.	2026	Mixed	108	Variable	SALT50	27/77 (35.1)
					SALT90	11/77 (14.3)
Silva et al.	2025	Baricitinib to ritlecitinib	15	Variable	SALT50	2/15 (13.3)
					SALT80	1/15 (6.7)
					SALT90	1/15 (6.7)

Study	Year	Switch direction	N	Follow-up	Outcome	n/N (%)
Okazaki et al.	2026	Baricitinib to ritlecitinib	13	Week 24	SALT50	3/13 (23.1)
					SALT75	1/13 (7.7)
					SALT90	1/13 (7.7)
King et al. (ALLEGRO COE)	2022	Mixed bidirectional (ritlecitinib/brepocitinib)	23	Week 24	SALT30	4/21 (19.0)
					SALT50	2/21 (9.5)
					SALT75	2/21 (9.5)
					SALT90	1/21 (4.8)
					SALT100	0/21 (0.0)
Katamanin et al.	2024	Mixed prior JAK to baricitinib	3	Variable	SALT50	3/3 (100.0)
					SALT75	1/3 (33.3)
					SALT80	1/3 (33.3)
					SALT90	1/3 (33.3)
					SALT100	0/3 (0.0)
Hayashi et al.	2026	Baricitinib to ritlecitinib	9	Week 24	SALT50	1/8 (12.5)
					SALT75	0/8 (0.0)

Study	Year	Switch direction	N	Follow-up	Outcome	n/N (%)
					SALT80	0/8 (0.0)
					SALT90	0/8 (0.0)
					SALT100	0/8 (0.0)

Supplementary Table S3

Continuous outcome extraction and derivation

Mean SALT reduction was calculated as pre-switch minus post-switch SALT; positive values indicate improvement. Derived from median and IQR as described in Materials and Methods. SALT, Severity of Alopecia Tool; SD, standard deviation.

Study	Cohort used	Patients (n)	Follow up time	Pre-switch SALT mean (SD)	Post-switch SALT mean (SD)	Mean SALT change	Source of change
Chen 2025	Baricitinib to ritlecitinib	15	24 weeks	79 (35.6)[1]	24 (32.6)[1]	55	Table 1
Ehsani 2025	Tofacitinib to baricitinib (overall)	26	Variable	68 (31)	50 (31)	18	Table 2
Engelking 2026	Mixed	18	NA	24.1 (23.3)	32.1 (27.4)	-8	Supplementary figure S1
Huang 2025	Prior JAKi to ritlecitinib	18	24 weeks	68.1 (30.2)	37.1 (31.9)	31	Text
Muñoz-Barba 2025	Tofacitinib to baricitinib	10	24 weeks	28.6 (7.9)	20.9	7.7 (9.8)	Figure 3
Nappa 2026	Baricitinib to ritlecitinib	32	24 weeks	74.4 (22.1)	43.7 (28.4)	30.7	Table 1
Silva 2025	Baricitinib to ritlecitinib	15	NA	65.3 (29.7)	52.3 (33.7)	13	Table 1
Okazaki 2026	Baricitinib to ritlecitinib	13	24 weeks	61.8 (39.4)	43.5 (33.3)	18.3	Figure 1
Hayashi 2026	Baricitinib to ritlecitinib	7	24 weeks	82.9 (17)	67.1 (25)	15.6	Figure 4

Supplementary Table S4

Risk of bias assessment

Quality appraisal of included observational studies (JBI Critical Appraisal Checklist for Case Series).

Legend: Y=Yes; N=No; UC=Unclear; NA=Not applicable. Overall judgement (Low/Moderate/High/Unclear) reflects our qualitative summary of concerns.

Q1, clear inclusion criteria; Q2, standard and reliable measurement of condition; Q3, valid identification of condition; Q4, consecutive inclusion; Q5, complete inclusion; Q6, clear demographics; Q7, clear clinical information; Q8, clear outcomes/follow-up; Q9, clear site information; Q10, appropriate statistical analysis.

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Overall
Chambres 2026	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	Moderate
Chen 2025	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	Moderate
Huang 2025	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Martin 2026	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	Moderate
Muñoz-Barba 2025	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Nappa 2026	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	Moderate
Silva 2025	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	Moderate
Okazaki 2026	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	Moderate
Katamanin 2024	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	Moderate
Hayashi 2026	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	Moderate
Kazmi 2023	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	Moderate
Ehsani 2025	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	Moderate
Engelking 2026	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	Moderate

Supplementary Table S5

GRADE summary of evidence

Certainty was assessed using the GRADE framework. Observational single-arm evidence was initially rated as low certainty. SALT, Severity of Alopecia Tool; CI, confidence interval; GRADE, Grading of Recommendations Assessment, Development and Evaluation.

Outcome	Studies / cohorts	Patients	Effect estimate	Certainty	Main reasons
SALT<=20 after switching	10 cohorts	208	44.5% (95% CI 31.2-58.7); I2 41.8%	Low	Uncontrolled observational evidence; heterogeneous switch criteria, switch directions, treatment lines, and follow-up. The estimate was stable in sensitivity and leave-one-out analyses.
SALT<=10 after switching	6 cohorts	151	32.2% (95% CI 20.3-47.1); I2 24.8%	Low	Uncontrolled observational evidence; fewer cohorts than the primary outcome; heterogeneous switch sequences and follow-up. Some values were derived from case tables or figures.
Mean SALT reduction from switch baseline	9 cohorts	154	19.5 points (95% CI 8.5-30.4); I2 86.1%	Very low	Uncontrolled observational evidence; serious inconsistency; variable follow-up; several estimates required conversion or reconstruction, including assumptions for change SD.

Supplementary Table S6. Characteristics of cohorts included in the primary SALT≤20 synthesis

SALT≤20 indicates ≤20% scalp hair loss after switching. Percentages were calculated using the denominator available for the selected cohort and follow-up. JAKi, Janus kinase inhibitor; SALT, Severity of Alopecia Tool.

Study	Design	Population included	Switch direction	Follow-up	SALT≤20, n/N (%)
Chambres 2026[1]	Multicenter Retrospective observational	Mixed	Baricitinib to upadacitinib	Variable	5/9 (55.6)
Chen 2025[2]	Single-center Retrospective observational	Adults/adolescents	Baricitinib to ritlecitinib	24 weeks	9/15 (60.0)
Huang 2025[3]	Single-center Retrospective observational	Adults/adolescents	Prior JAKi to ritlecitinib	24 weeks	11/17 (64.7)
Martin 2026[4]	Multicenter Retrospective observational	Mixed	Mixed oral JAKi to oral JAKi	Variable	42/86 (48.8)
Muñoz-Barba 2025[5]	Single-center Prospective observational	Adults/adolescents	Tofacitinib to baricitinib	24 weeks	8/10 (80.0)
Nappa 2026[6]	Single-center Retrospective observational	Adults/adolescents	Baricitinib to ritlecitinib	24 weeks	9/32 (28.1)
Silva 2025[7]	Single-center Retrospective observational	Adults/adolescents	Baricitinib to ritlecitinib	Variable	4/15 (26.7)
Okazaki 2026[8]	Single-center Retrospective observational	Adults/adolescents	Baricitinib to ritlecitinib	24 weeks	4/13 (30.8)
Katamanin 2024[9]	Single-center Retrospective observational	Adults/adolescents	Mixed prior JAKi to baricitinib	Variable	2/3 (66.7)
Hayashi 2026[10]	Single-center Retrospective observational	Adults/adolescents	Baricitinib to ritlecitinib	24 weeks	0/8 (0.0)

Supplementary Figures

Figure S1. Sensitivity analysis restricted to exact or approximate 24-week assessments for SALT≤20

Random-effects meta-analysis of the proportion of patients achieving SALT≤20 after switching between oral JAK inhibitors, restricted to studies reporting exact or approximate 24-week follow-up. SALT, Severity of Alopecia Tool; CI, confidence interval.

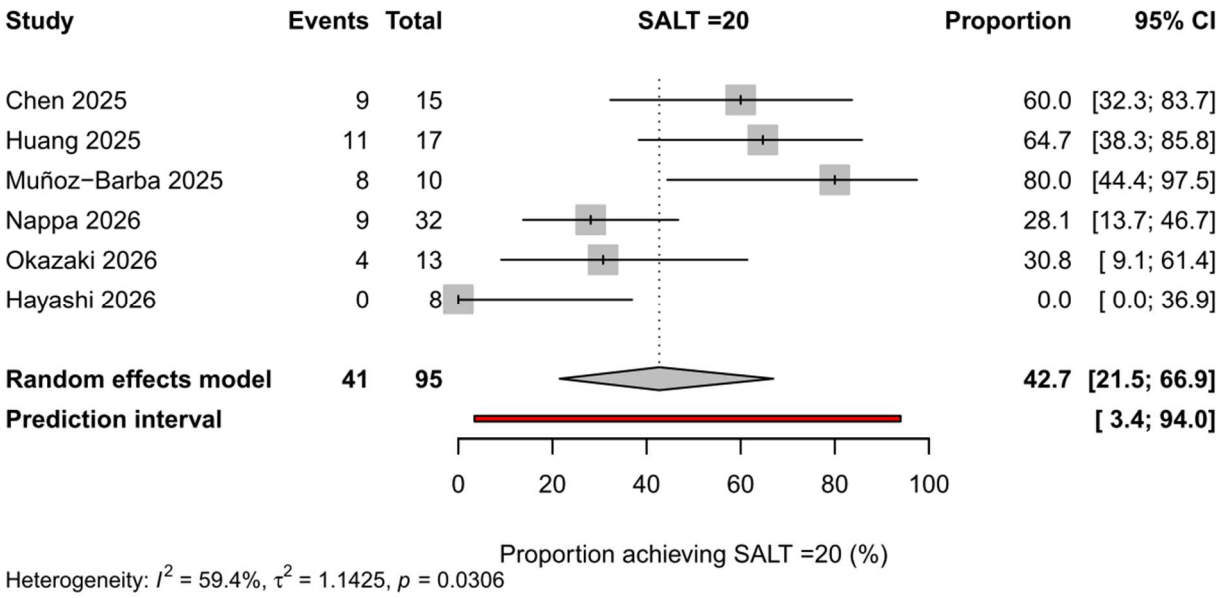


Figure S2. Sensitivity analysis excluding very small-study evidence for SALT≤20

Random-effects meta-analysis of the proportion of patients achieving SALT≤20 after switching between oral JAK inhibitors, excluding studies with n≤10. SALT, Severity of Alopecia Tool; CI, confidence interval.

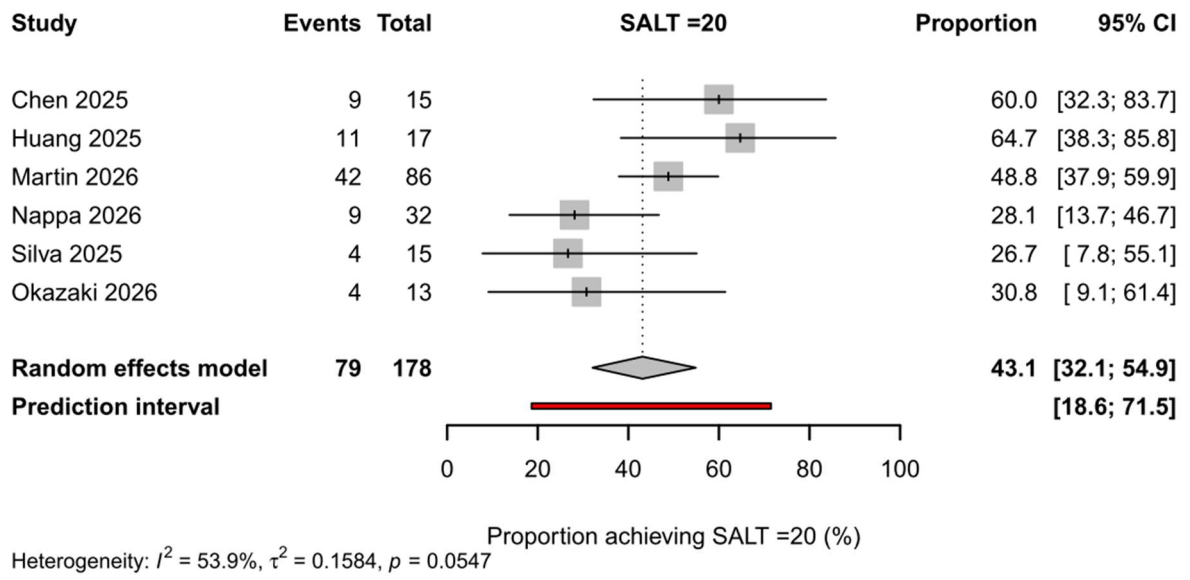


Figure S3. Leave-one-out analysis for SALT≤20

Leave-one-out random-effects estimates for the proportion of patients achieving SALT≤20 after switching between oral JAK inhibitors. The dashed line indicates the main pooled estimate. SALT, Severity of Alopecia Tool.

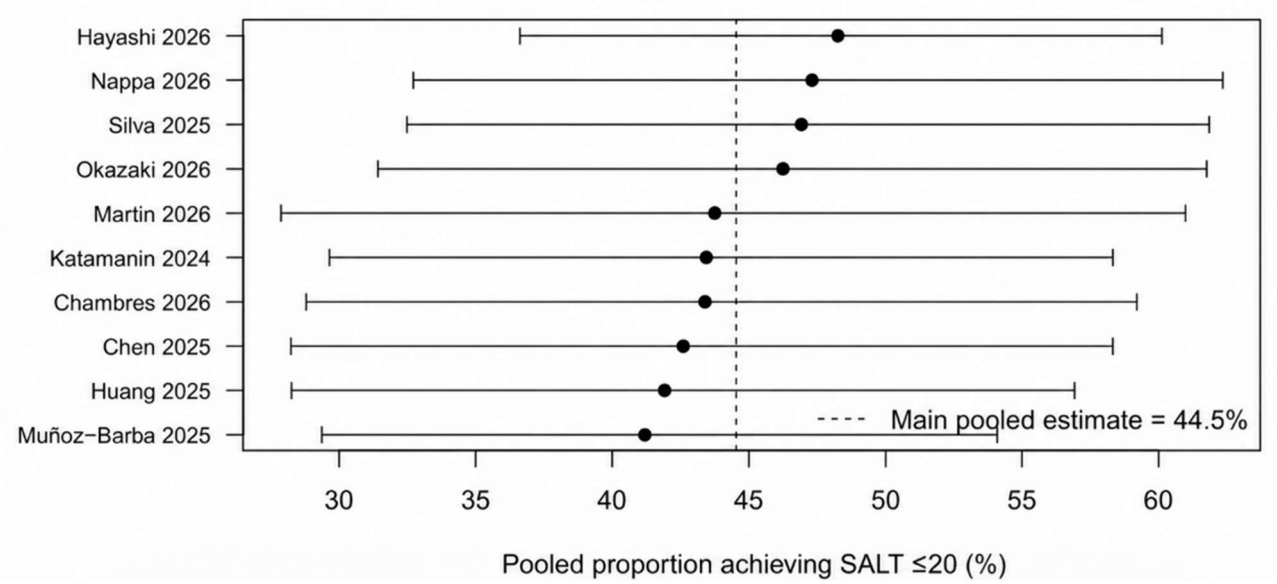


Figure S4. Funnel plot for SALT≤20

Funnel plot of logit-transformed proportions achieving SALT≤20 after switching between oral JAK inhibitors. Egger test did not suggest small-study effects. SALT, Severity of Alopecia Tool.

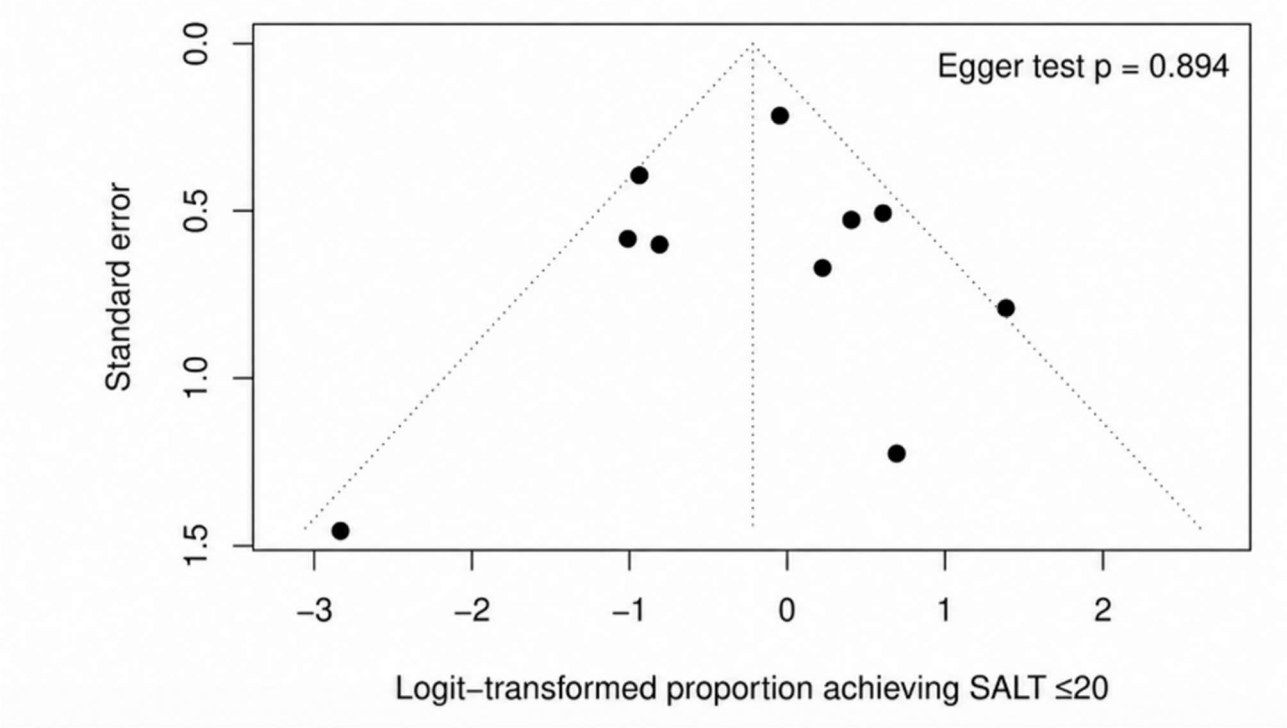
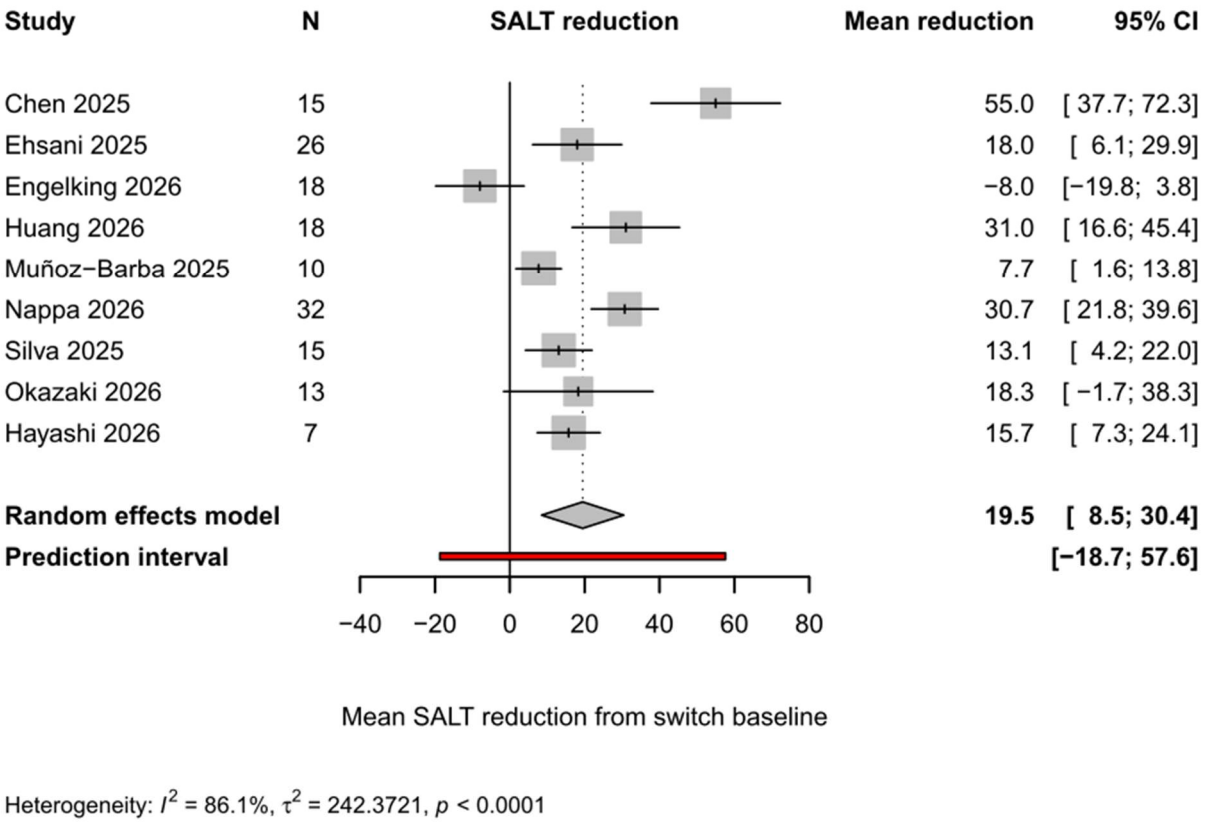


Figure S5. Meta-analysis of mean SALT reduction after switching.

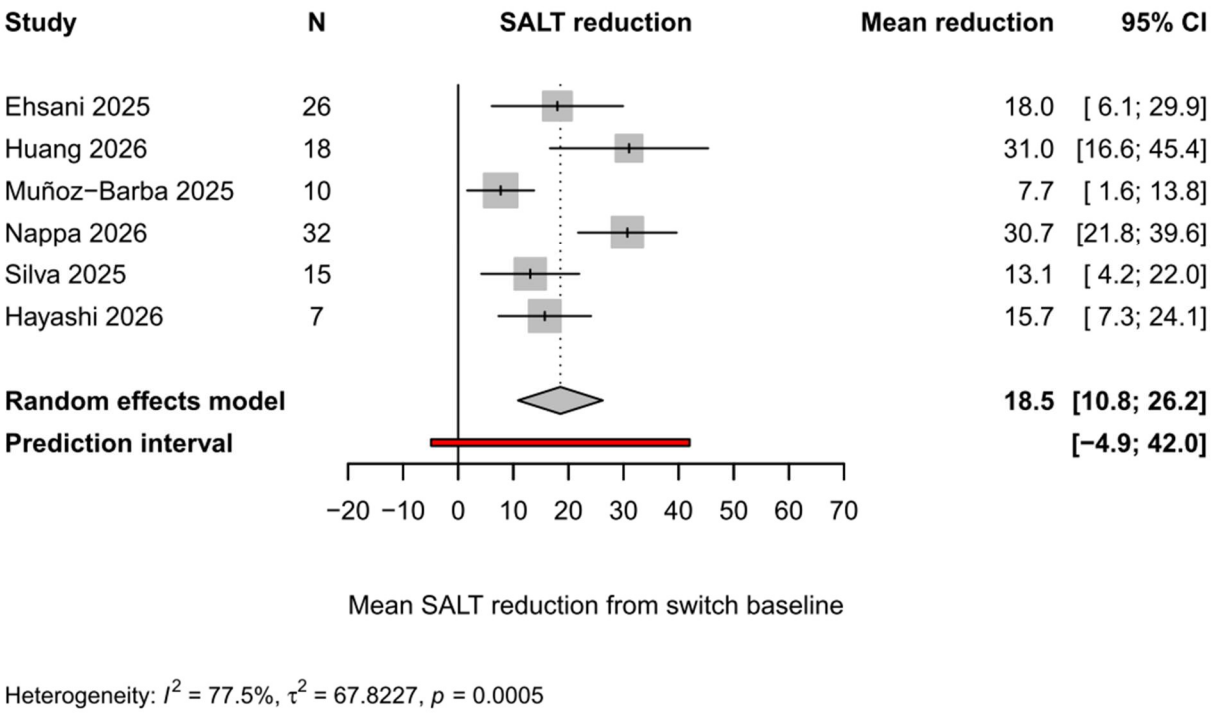
Random-effects meta-analysis of mean SALT reduction from switch baseline after switching between oral JAK inhibitors. Positive values indicate improvement. SALT, Severity of Alopecia Tool; CI, confidence interval.



Heterogeneity: I^2 = 86.1%, τ^2 = 242.3721, p < 0.0001

Figure S6. Sensitivity analysis for mean SALT reduction after exclusion of converted or indirectly derived estimates

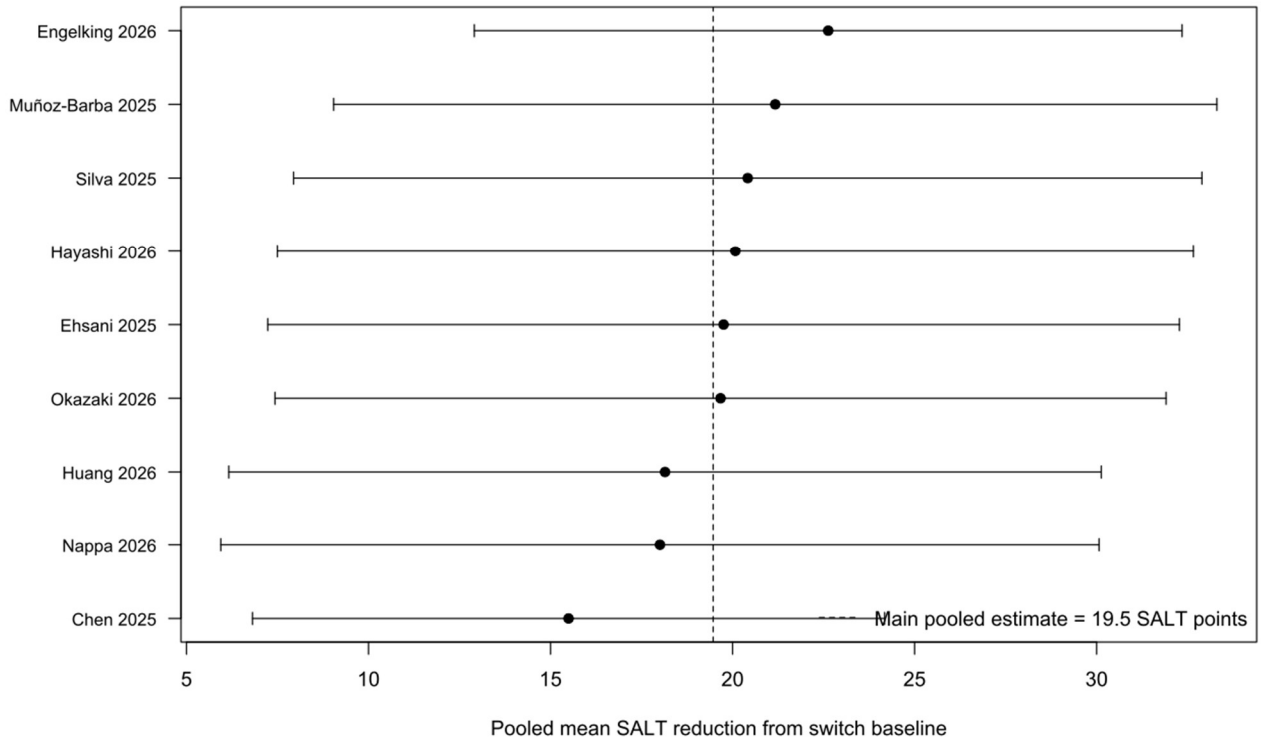
Random-effects meta-analysis of mean SALT reduction from switch baseline after exclusion of studies with converted or indirectly derived continuous estimates. Positive values indicate improvement. SALT, Severity of Alopecia Tool; CI, confidence interval.



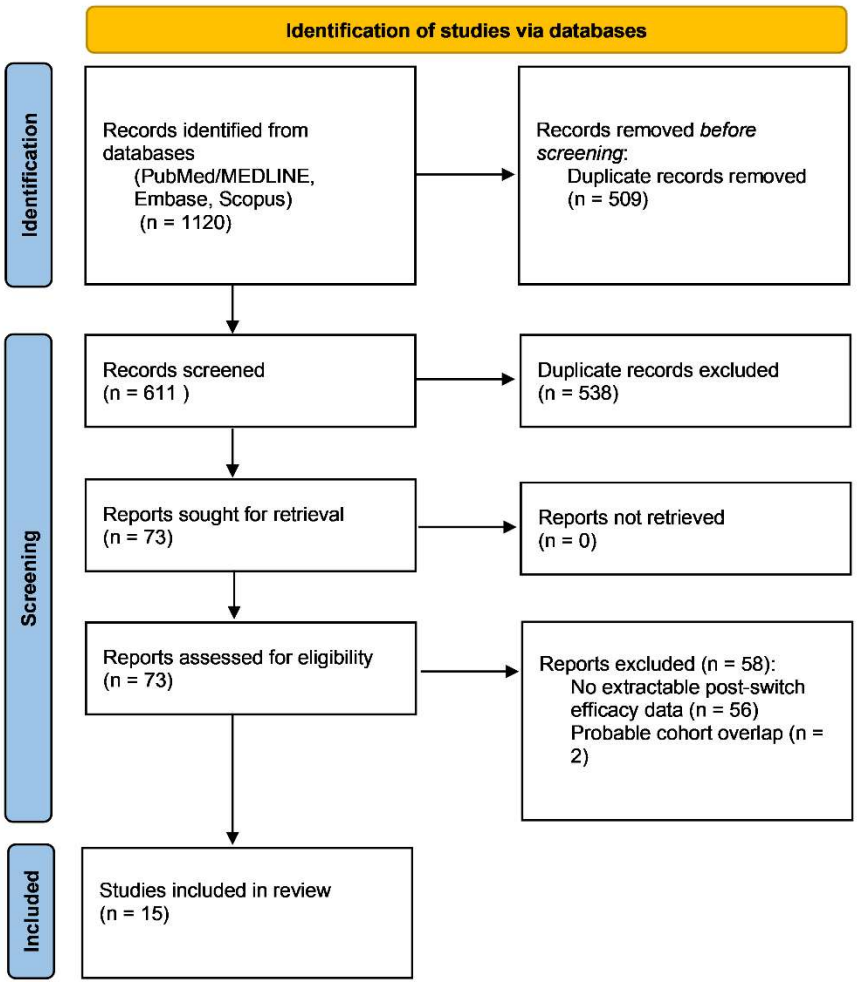
Heterogeneity: I^2 = 77.5%, τ^2 = 67.8227, p = 0.0005

Figure S7. Leave-one-out analysis for mean SALT reduction

Leave-one-out random-effects estimates for mean SALT reduction from switch baseline. The dashed line indicates the main pooled estimate. SALT, Severity of Alopecia Tool.



Supplementary Figure S8. PRISMA flow diagram of study selection.



References:

1. Chambres F, Tétart F, Janela-Lapert R, *et al.* Efficacy of upadacitinib in patients with severe alopecia areata, including baricitinib-refractory cases: A case series of 22 patients. *J Am Acad Dermatol* 2026;**94**:269–71.

2. Chen Y, Xu Q, Lv X, *et al.* Efficacy and safety of switching from baricitinib to ritlecitinib in severe alopecia areata. *Clin Exp Dermatol* 2025;**50**:1228–30.

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