E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.48047/ijprt/15.02.331

Research Article

Bone Mineral Density in Patients with Atopic Dermatitis on Chronic Topical/Oral Corticosteroids

Dr. Kiran Chahal[1], Dr. Udit[2], Dr. Dhananjay Malage[3], Mr. Vishal Pol[4]

[1]Assistant professor, Department of Dermatology, Dr. N Y Tasgaonkar Medical College and Hospital Karjat, Maharashtra, India.

[2]Assistant professor, Department of Orthopaedics, NC medical college and hospital, Israna, Panipat (Haryana), India.

[3]Consultant Dermatologist- Skin Science Clinic, Nerul, Navi Mumbai, India.

[4]Statistician, D Y Patil University School of Medicine, Ambi, Pune, Maharashtra, India.

Corresponding author: Dr. Dhananjay Malage

Abstract

Background:
Atopic dermatitis (AD) is a chronic inflammatory skin disorder frequently managed with corticosteroids. Long-term systemic corticosteroid therapy is associated with reduced bone mineral density (BMD), while the effects of chronic topical corticosteroids on bone health are less clearly defined. **Objective:** To assess BMD among AD patients receiving chronic corticosteroid therapy and compare the impact of topical-only versus oral corticosteroid exposure. **Methods:** A cross-sectional study of 50 adults with AD on corticosteroid therapy for ≥6 months was conducted at a tertiary dermatology center. Patients were categorized into: **Group T (Topical only):** n = 30 and **Group O (Oral exposure):** n = 20. Dual-energy X-ray absorptiometry (DEXA) was used to measure lumbar spine and femoral neck BMD. T-scores were analyzed per WHO criteria. Statistical tests included t-test, chi-square, correlation, and multivariate regression. **Results:** Mean age was 42.6 ± 12.3 years; 56% were female. Mean AD duration was 8.2 ± 5.1 years, and mean corticosteroid exposure was 6.5 ± 4.2 years. Lumbar spine T-scores were significantly lower in Group O (−1.60 ± 0.84) than Group T (−0.90 ± 0.78; $p = 0.002$). Osteopenia/osteoporosis occurred in 17/20 (85%) of Group O vs. 11/30 (36.7%) of Group T ($p < 0.001$). Cumulative oral corticosteroid dose correlated negatively with lumbar T-score ($r = -0.52$, $p < 0.001$). **Conclusion:** Chronic oral corticosteroid exposure in AD is associated with significant BMD reduction and higher prevalence of osteopenia/osteoporosis compared with topical-only therapy. Regular BMD screening and preventive bone health strategies are recommended.

Keywords: Atopic dermatitis, corticosteroids, bone mineral density, osteoporosis, DEXA, glucocorticoids

Introduction

Although the skeletal risks of systemic steroids are well established, the effects of chronic topical steroids, particularly when used extensively or under occlusion, remain underexplored. This study aimed to compare BMD in AD patients treated with chronic topical versus oral corticosteroids.[1]

Atopic dermatitis (AD) is a common chronic, pruritic inflammatory skin disease, which afflicts not only 10–20% of children and adolescents, but also 2–10% adults around the world. [2-5]

With an increasing prevalence of AD and its manifestation in developed and developing countries, together with more supporting evidence of the progression to other long-term sequelae, AD has developed into a worldwide public health problem and burden. [5]

During the past years, there is growing evidence that suggests that people who suffer from AD are more likely to have a lower bone mineral density (BMD), higher prevalence of osteopenia, osteoporosis, and related fractures when compared with those without AD. [6-10] However, evidence of the potential association between AD and abnormalities in the bone mineral metabolism remains fragmented. As osteoporosis and fracture are associated with increased morbidity and mortality, which also represents a significant public health challenge, a better understanding of the relationship between AD and abnormal bone metabolism would help to clarify this issue and intervene earlier, if needed. [11-15]

Materials and Methods

Study Design and Participants

This cross-sectional observational study was conducted in the Department of Dermatology at Dr. N Y Tasgaonkar Medical College and Hospital Karjat, Maharashtra, India during the study period from January 2025 to August 2025. Fifty adult patients with clinically diagnosed AD and ≥6 months of corticosteroid therapy were included.

Inclusion Criteria

- Adults ≥18 years old with chronic AD
- Minimum 6 months of corticosteroid use (topical and/or oral)

Exclusion Criteria

- Known metabolic bone disease
- Use of other bone-affecting drugs (bisphosphonates, anticonvulsants, etc.)
- Pregnancy or postmenopausal status

Study Groups

Group	Exposure Type	N
Group T	Topical corticosteroids only	30
Group O	Oral corticosteroids (with or without topical use)	20

Data Collection

Clinical data included age, sex, BMI, disease duration, corticosteroid type, potency, cumulative dose, and exposure duration. All participants underwent DEXA scanning (lumbar spine L1–L4 and femoral neck).

Statistical Analysis

Continuous variables were expressed as mean ± SD and compared using Student's *t*-test. Categorical data were analyzed by chi-square test. Correlations were assessed using Pearson's coefficient. $p < 0.05$ was considered statistically significant.

Results

Table 1: Baseline Characteristics

Variable	Group T (n=30)	Group O (n=20)	*p*-value
Age (years)	40.1 ± 11.8	46.9 ± 12.1	0.03
Female (%)	53.3	60	0.63
BMI (kg/m²)	24.4 ± 3.6	23.6 ± 4.1	0.46
AD Duration (years)	7.3 ± 4.6	9.6 ± 5.6	0.12
Corticosteroid Exposure (years)	5.8 ± 3.9	7.5 ± 4.6	0.18

The table presents the **baseline characteristics** of 50 patients with atopic dermatitis (AD) divided into two groups — those using **topical corticosteroids only (Group T)** and those with **oral corticosteroid exposure (Group O)**.

- **Age:**
  The mean age of patients in Group T was **40.1 ± 11.8 years**, while that in Group O was **46.9 ± 12.1 years**. This difference was **statistically significant (p = 0.03)**, indicating that patients on oral corticosteroids were generally older.

- **Sex Distribution (Female %):**
  Females constituted **53.3%** of Group T and **60%** of Group O. The difference was **not significant (p = 0.63)**, suggesting comparable gender distribution across groups.

- **Body Mass Index (BMI):**
  The mean BMI was **24.4 ± 3.6 kg/m²** in Group T and **23.6 ± 4.1 kg/m²** in Group O. This difference was **not statistically significant (p = 0.46)**, showing that both groups had similar nutritional status.

- **Atopic Dermatitis (AD) Duration:**
  The average disease duration was **7.3 ± 4.6 years** in Group T and **9.6 ± 5.6 years** in Group O. Although Group O had a longer disease history, the difference was **not significant (p = 0.12)**.

- **Corticosteroid Exposure Duration:**
  Patients in Group O had been exposed to corticosteroids for a mean duration of **7.5 ± 4.6 years**, compared with **5.8 ± 3.9 years** in Group T. This difference was **not statistically**

significant (p = 0.18), but the trend suggests longer steroid use among oral corticosteroid users.

Both groups were broadly comparable in terms of sex, BMI, disease duration, and corticosteroid exposure. The only statistically significant difference was age, with oral corticosteroid users being older. This comparability supports the validity of subsequent comparisons of bone mineral density between the two groups.

Table 2: Bone Mineral Density Findings

Site	Group T	Group O	*p*-value
Lumbar spine T-score	−0.90 ± 0.78	−1.60 ± 0.84	0.002
Femoral neck T-score	−0.70 ± 0.78	−1.25 ± 0.75	0.01

This table compares the **Bone Mineral Density (BMD)** between patients with atopic dermatitis treated with **topical corticosteroids only (Group T)** and those with **oral corticosteroid exposure (Group O)** at two skeletal sites — the **lumbar spine** and **femoral neck** — as measured by DEXA scan.

Lumbar Spine T-score: The mean lumbar spine T-score was significantly lower in patients who had taken oral corticosteroids compared with those using only topical corticosteroids. This indicates that **oral corticosteroid users had greater bone loss** and were more likely to have **osteopenia or osteoporosis** in the lumbar spine region. The difference is statistically significant ($p < 0.01$), suggesting a true association rather than a random variation.

Femoral Neck T-score: The femoral neck T-scores were also lower among oral corticosteroid users compared to topical users, indicating **reduced bone density at the hip region**. This difference is statistically significant ($p = 0.01$), again demonstrating that oral corticosteroid therapy negatively affects bone mineral density.

Table 3: Prevalence of Low BMD

Category	Group T (n=30)	Group O (n=20)	Total (n=50)	*p*-value
Normal BMD	19 (63.3%)	3 (15.0%)	22 (44.0%)	<0.001
Osteopenia	10 (33.3%)	12 (60.0%)	22 (44.0%)	0.06
Osteoporosis	1 (3.3%)	5 (25.0%)	6 (12.0%)	0.02
Any Low BMD	11 (36.7%)	17 (85.0%)	28 (56.0%)	<0.001

This table summarizes the distribution of bone mineral density (BMD) status among patients with atopic dermatitis (AD) treated with topical corticosteroids only (Group T) and those exposed to oral corticosteroids (Group O). The findings are categorized as Normal BMD, Osteopenia, and Osteoporosis, based on WHO T-score criteria.

Normal BMD: A significantly higher proportion of patients with normal BMD was observed in the topical corticosteroid group compared to the oral group. This indicates that **oral corticosteroid users had markedly lower bone density**, with far fewer maintaining normal bone health.

Osteopenia: Osteopenia (mild reduction in BMD) was more common among oral corticosteroid users. Although the difference was not statistically significant (p = 0.06), the trend suggests a higher prevalence of bone loss in the oral steroid group.

Osteoporosis: Osteoporosis (severe bone loss) was significantly more frequent among oral corticosteroid users compared to topical users (p=0.02). This reinforces the strong link between systemic steroid use and high fracture risk.

Any Low BMD (Osteopenia + Osteoporosis): When combining all cases of reduced bone density, **85% of oral corticosteroid users** had either osteopenia or osteoporosis, compared to only **36.7% of topical users**. This difference is highly significant, clearly demonstrating that **oral corticosteroid exposure substantially increases the risk of low bone mineral density**.

Table 4: Correlation table

Variable / Predictor	Statistical Test	Correlation Coefficient (r) / Beta (β)	p-value	Interpretation
Cumulative oral corticosteroid dose	Pearson correlation	r = −0.52	< 0.001	Significant negative correlation with lumbar spine T-score — higher steroid dose associated with lower BMD.
Age	Pearson correlation	r = −0.48	0.001	Significant negative correlation — older age associated with reduced bone mineral density.
Oral steroid exposure	Multivariate linear regression	β = −0.45	0.002	Independent predictor of low BMD even after adjusting for confounders.

Cumulative oral corticosteroid dose negatively correlated with lumbar spine T-score (r = −0.52, p < 0.001). Age correlated with lower BMD (r = −0.48, p = 0.001). Multivariate regression identified oral steroid exposure as an independent predictor of low BMD (β = −0.45, p = 0.002).

Discussion

This study demonstrates a clear negative effect of oral corticosteroid exposure on bone health in patients with AD. The prevalence of osteopenia/osteoporosis in oral corticosteroid users (85%) is markedly higher than in topical-only users (36.7%). These findings are consistent with known mechanisms of glucocorticoid-induced osteoporosis, including reduced bone formation and increased resorption. While topical corticosteroids have lower systemic absorption, chronic use—especially of high-potency preparations—may still pose mild risk, emphasizing the importance of monitoring cumulative exposure.

In our study, significantly higher proportion of patients with normal BMD was observed in the topical corticosteroid group compared to the oral group. This indicates that oral corticosteroid users had markedly lower bone density, with far fewer maintaining normal bone health. Osteopenia (mild reduction in BMD) was more common among oral corticosteroid users. Although the difference was not statistically significant (p = 0.06), the trend suggests a higher prevalence of bone loss in the oral steroid group. Osteoporosis (severe bone loss) was significantly more frequent among oral corticosteroid users compared to topical users (p = 0.02). This reinforces the strong link between systemic steroid use and high fracture risk.

A study by **Haeck IM et al**[16] reported that low bone mineral density in adult patients with Moderate to Severe Atopic Dermatitis (n = 125). Osteoporosis in ~4.8% among all AD patients; osteopenia in ~32.8%. That study found ~30.4% had a Z-score ≤ −1 (i.e., low bone density). Importantly, they *did not* find a statistically significant association between low BMD and the cumulative dose of topical/oral corticosteroids in the previous 5 years.

van Velsen, Sara G.A. et al[17] included 75 cases of AD and over 2 years, no significant change in BMD from baseline among those using topical corticosteroids—even when comparing higher vs lower monthly topical steroid amounts. The number of patients with T-score < −1 did not differ significantly from baseline to follow-up (41.3% at baseline vs 44.3% at follow-up).

Salem D. et al[18] reported that significant reduction in BMD found in those taking systemic/oral corticosteroids: lumbar spine and hip (left hip) more affected. Oral steroids had a more profound effect than pulse IV therapy in lumbar spine.

van Staa TP et al[19] reported that meta-analysis (Oral corticosteroid use) showed that cumulative dose and daily dose correlate strongly with lost BMD and increased fracture risk. Even relatively low daily doses (e.g., > 5 mg prednisolone equivalent) are associated with measurable BMD loss.

Limitations

- Cross-sectional design cannot establish causality.
- Small sample size from a single center.
- Biochemical bone markers (e.g., Vitamin D, ALP) not included.

Conclusion

Chronic oral corticosteroid therapy in AD is strongly associated with reduced BMD and increased risk of osteopenia/osteoporosis compared with topical-only therapy. Periodic BMD assessment and prophylactic measures such as calcium, vitamin D supplementation, and steroid-sparing regimens are recommended.

Conflict of interest: None

Source of funding: Self funded

References

1. Williams H, Stewart A, von Mutius E. Is eczema really on the increase worldwide? J Allergy Clin Immunol 2008; 121:947-54.e15.
2. Odhiambo JA, Williams HC, Clayton TO. Global variations in prevalence of eczema symptoms in children from ISAAC Phase Three. J Allergy Clin Immunol 2009; 124:1251-8.e23.
3. de Mel S, Nordlind K, Holst M. Polymorphisms in the serotonin transporter gene of patients with atopic dermatitis-association with personality traits related to high level of anxiety. Immunopharmacol Immunotoxicol 2012; 34:534-8.
4. Silverberg JI, Hanifin JM. Adult eczema prevalence and associations with asthma and other health and demographic factors: A US population–based study. J Allergy Clin Immunol 2013; 132:1132-8.
5. Pedreira CC, King E, Jones G. Oral cyclosporin plus topical corticosteroid therapy diminishes bone mass in children with eczema. Pediatr Dermatol 2007; 24:613-20.
6. Penterich V, Yang A, Pereira R. Nutritional Status and Bone Metabolism in Children With Atopic Dermatitis. J Pediatr Endocrinol Metab 2018; 31:247-60.29397388
7. Silverberg JI. Association between childhood atopic dermatitis, malnutrition, and low bone mineral density: A US population-based study. Pediatr Allergy Immunol 2015; 26:54-61.
8. Leung TF, Wang SS, Kwok FY. Assessment of dietary food and nutrient intake and bone density in children with eczema. Hong Kong Med J 2017; 23:470-9.
9. Aalto-Korte K, Turpeinen M. Bone mineral density in patients with atopic dermatitis. Br J Dermatol 1997; 136:172-5.
10. Garg N, Silverberg JI. Association between eczema and increased fracture and bone or joint injury in adults: a US population-based study. JAMA Dermatol 2015; 151:33-41.
11. Garg NK, Silverberg JI. Eczema is associated with osteoporosis and fractures in adults: a US population-based study. J Allergy Clin Immunol 2015; 135:1085-7.e2.
12. Wu CY, Lu YY, Lu CC. Osteoporosis in adult patients with atopic dermatitis: A nationwide population-based study. PLoS One 2017;12:e0171667. 10.1371/journal.pone.0171667
13. Lowe KE, Mansfield KE, Delmestri A. Atopic eczema and fracture risk in adults: A population-based cohort study. J Allergy Clin Immunol 2020; 145:563-71.e8.
14. Shaheen MS, Silverberg JI. Atopic dermatitis is associated with osteoporosis and osteopenia in older adults. J Am Acad Dermatol 2019; 80:550-1.
15. Higgins JP, Thomas J, Chandler J. Cochrane handbook for systematic reviews of interventions. Chichester (UK): John Wiley & Sons, 2019.

16. Haeck IM, Hamdy NA, Timmer-de Mik L, Lentjes EG, Verhaar HJ, Knol MJ, de Bruin-Weller MS, Bruijnzeel-Koomen CA. Low bone mineral density in adult patients with moderate to severe atopic dermatitis. Br J Dermatol. 2009 Dec;161(6):1248-54.
17. van Velsen, Sara G.A. Two-year assessment of effect of topical corticosteroids on bone mineral density in adults with moderate to severe atopic dermatitis. J Am Acad Dermatol. 2011.
18. Salem D, Talaat S, Abdel-Halim MR, Mohsen KM. Assessment of bone mineral density by dual x-ray absorptiometry in dermatological patients treated by corticosteroids. Indian J Dermatol. 2010 Jul-Sep;55(3):238-45.
19. van Staa TP, Leufkens HG, Cooper C. The epidemiology of corticosteroid-induced osteoporosis: a meta-analysis. Osteoporos Int. 2002 Oct;13(10):777-87.