Optimizing Glucocorticoid-Induced Osteoporosis Management: A Cross-Sectional Study of Healthcare Worker Awareness

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ABSTRACT

This study aimed to assess healthcare providers' knowledge, attitude, and self-reported practice regarding preventive measures for glucocorticoid-induced osteoporosis for patients on prolonged glucocorticoid therapy at King Abdulaziz University Hospital. A descriptive cross-sectional study was conducted from January 1, 2023, to September 20, 2023. Participants included consultants and residents from the Departments of Internal Medicine and Family Medicine who routinely prescribed systemic corticosteroids. Data were analyzed using SPSS software. The study included 98 participants with equal sex distribution. Findings showed a strong knowledge base among participants regarding glucocorticoid-induced osteoporosis. Overall, 58.2% correctly recognized the dose threshold for preventive treatment, and many identified lifestyle factors and criteria for high-risk groups. Barriers to antiresorptive therapy were patient concerns about adverse effects (53.1%), complex medication regimens (54.1%), and time constraints (41.8%). Knowledge levels and less frequent prescription of corticosteroids were positively correlated with experienced consultants. Participants demonstrated strong knowledge, with opportunities to enhance consistent use of preventive guidelines and address barriers to antiresorptive therapy. Specialization within internal medicine subspecialties, years of experience, and knowledge levels influence glucocorticoid-induced osteoporosis management practices.

Keywords: Antiresorptive therapy; dose threshold; Glucocorticoid; osteoporosis; prevention.

INTRODUCTION

Glucocorticoids are medications similar to cortisol, a hormone produced in the body[1]. They are powerful anti-inflammatory drugs used for many decades to treat diseases such as asthma, rheumatoid arthritis, and inflammatory bowel disease[2]. Glucocorticoids have minor and serious side effects, including osteoporosis, gastrointestinal, hepatic, ophthalmologic effects, hyperlipidemia, growth suppression, adrenal insufficiency, and fatal problems[3]. Glucocorticoid-induced osteoporosis (GIOP) is a significant side effect, the most prevalent type of secondary osteoporosis, and a primary cause of osteoporosis in young individuals. Bone weakness is associated with the dose and duration of glucocorticoid medication[4].

Osteoporosis, characterized by a change in bone architecture due to reduced bone mineral density (BMD), increases fracture risk. Osteoporosis affects over 200 million people worldwide yearly and can be life-threatening in older individuals[5]. Physicians, patients, and healthcare system barriers contribute to the under-recognition and under-treatment of osteoporosis[6]. Glucocorticoid prescriptions should be limited, and patients using this medication should be counselled on lifestyle changes to maintain bone strength, assessed for fracture risk and treated when high risk is detected[7]. In Saudi Arabia, osteoporosis affects one-third of adults aged 50–79, and chronic glucocorticoid use ranks first among secondary causes of osteoporosis at all ages[8].

Steroids inhibit osteoblasts, decrease calcium absorption in the intestine, and increase calcium excretion in the kidney. The American College of Rheumatology recommends BMD testing for patients using steroids for more than 6 months, whereas the Osteoporosis Society of Canada recommends BMD testing for those using >2.5 mg/day of prednisone for more than 3 months[8]. However, primary prevention of GIOP remains a problem, as only 25% of chronic glucocorticoid users have undergone BMD testing or osteoporosis therapy. The effectiveness of calcium and vitamin D supplementation in improving BMD among glucocorticoid users remains unclear. Despite sophisticated approaches for fracture risk assessment and effective treatment options, the clinical management of GIOP remains suboptimal, with bisphosphonates being the most popular medications for protecting the bones of patients using glucocorticoids[9].

A study in Iceland in 2001 to assess glucocorticoid use and active interventions for GIOP showed that 52% and 37% of patients received vitamin D and calcium supplementation, respectively, whereas 91% consumed milk products regularly[10]. Another study in Chiang Mai in 2007 investigating physician awareness of GIOP prevention reported that internal medicine specialists failed to prevent GIOP[11], similar to another study in Groningen in 2011 assessing prescribers' knowledge and likely prescribing patterns regarding GIOP diagnosis and treatment, indicating a lack of knowledge, particularly regarding BMD testing[12].

Further investigations in Manitoba, Canada, showed changes in GIOP preventative care from 1998 to 2008, revealing a moderate increase in the use of osteoporosis therapy, BMD testing, and treatment[13]. A study in Saudi Arabia assessing whether patients with prolonged steroid use were being screened for osteoporosis reported that doctors did not follow preventive measures and lacked awareness of screening patients with prolonged steroid use[8]. Another Korean study reported that GIOP care in Korea involves using several medications and excellent

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guidelines and recommendations, suggesting that GIOP may be a significant public health concern[14].

A study at the University of Al-Khobar's King Fahd Hospital on patients receiving chronic glucocorticoid therapy highlighted the underutilization of preventive measures and the high prevalence of osteoporosis in these patients, indicating the need for increased awareness, screening, and appropriate management to prevent further bone loss and complications[15]. Another retrospective study at King Fahad University Hospital on glucocorticoid-related osteoporotic fractures reported an average of 12.6 osteoporosis-related fractures per year in hospitals compared with 15.1 GIOP-related fractures[16].

The updated recommendations of the Saudi Osteoporosis Society in 2023 for osteoporosis screening include screening those receiving long-term glucocorticoid therapy. The FRAX® tool was established using a cluster of risk factors to predict fracture risk independent of BMD. These include sex, age, body mass index (BMI), alcohol consumption, smoking status, glucocorticoid medication use, rheumatoid arthritis, prior fracture, history of parental fracture, BMD, and conditions strongly linked to secondary osteoporosis. Patients with a high fracture risk assessment score (FRAX) warrant treatment[17].

To obtain the greatest possible benefit of glucocorticoids with minimal side effects, physicians should be aware of their side effects, precautions, and duration of use[18]. However, previous studies have reported low GIOP knowledge and low use of preventive measures among doctors. Therefore, our study aimed to assess healthcare providers' knowledge, attitude, and self-reported practice regarding GIOP preventive measures at King Abdulaziz University Hospital.

METHODS

Study design and setting: A non-interventional, cross-sectional online survey was conducted among physicians at King Abdulaziz University Hospital in Jeddah, Saudi Arabia. The study targeted consultants, fellows, and residents from the internal medicine and family medicine departments.

Data collection tool and validity: No appropriate previously validated questionnaire was available. The questionnaire consisted of 32 questions divided into four sections. The first section contained a consent form, informing healthcare providers that personal information was not required and that the data collected for educational purposes. The second section gathered demographic and knowledge data, including sex, age, specialty, professional level, years of experience, weekly glucocorticoid prescriptions, and treated conditions. The third section included 12 questions on GIOP guidelines, clinical significance, preventive treatment, optimal doses of calcium and vitamin D, contributing factors, recommended exercises, criteria for identifying high-risk groups, GIOP medications, and better alternatives. The final section had 11 questions assessing attitudes and self-reported practices regarding barriers to antiresorptive therapies. Responses were categorized as "strongly agree," "agree," "neither agree nor disagree," "disagree," or "strongly disagree."

Participants: The pilot study: three endocrinology consultants, two rheumatology consultants, one general internal medicine consultant, one respiratory consultant, four family medicine consultants, two internal medicine residents, and six family medicine residents. The questionnaire was evaluated for clarity, time required for completion,

Table 1. Sociodemographic characteristics of the participants

		N	%
Sex	Male	49	50.0%
	Female	49	50.0%
Age (years)	20–30	39	39.8%
	31–40	32	32.7%
	40-50	14	14.3%
	More than 50	13	13.3%
Specialty:	Internal medicine	66	67.3%
	Family medicine	32	32.7%
If it is internal medicine, write your subspecialty (N = 66)	General internal medicine	27	27.6%
	Endocrinology	10	10.2%
	Pulmonology	9	9.2%
	Gastroenterology	5	5.1%
	Rheumatology	4	4.1%
	Infectious disease	4	4.1%
	Nephrology	3	3.1%
	Oncology	2	2.0%
	Immunology	1	1.0%
	Cardiology	1	1.0%
Professional level	Consultant	47	48.0%
	Resident	34	34.7%
	Fellow	12	12.2%
	Registrar or senior registrar	4	4.1%
	House officer/intern	1	1.0%
Years of experience since graduation (years)	≤5	48	49.0%
	>20	16	16.3%
	11–15	16	16.3%
	6–10	13	13.3%
	16–20	5	5.1%

and consistency with the study's objectives. A test-retest method was conducted on 13 responses, yielding a Pearson correlation coefficient of 0.887 (P-value = .000) and a test-retest correlation coefficient of ≥+.80, confirming good reliability.

Sampling method and sample size: The study calculated a sample size of 120 participants from an estimated population of 180, with a 5% margin of error and a 95% confidence interval, using Steven Thompson and Robert Mason's equations. The questionnaire was distributed via email and direct approach in clinics, with the principal investigator's email provided for responses and feedback. The target population included endocrinologists, internal medicine physicians, and family medicine physicians at King Abdulaziz University Hospital. Non-responders were excluded.

Statistical analysis: Analysis was performed using descriptive and inferential statistics. Demographic characteristics were described using frequencies and percentages. Chi-square tests evaluated associations between categorical variables. Analyses were performed using IBM's Statistical Package for the Social Sciences (SPSS) software version 27.0.1. For continuous variables, medians and interquartile ranges (IQRs) were reported as measures of central tendency and dispersion due to the non-normal distribution of variables assessed using the Kolmogorov–Smirnov test (P<.001). For the 12 questions used to assess knowledge and awareness of GIOP, a score of 1 was assigned to each correct response, and these were summed to calculate the total knowledge score for each participant. Three of the 12 questions had multiple correct answers, and a score of 1 was assigned to each correct answer. The total possible score ranged from 0 to 23. Scores were compared by sociodemographic and professional characteristics and practices using the Mann–Whitney U and Kruskal–Wallis tests. Statistical significance was set at a p-value of 0.05, indicating a 95% confidence interval. All statistical analyses were performed using IBM SPSS version 27.0.1.

RESULTS

Sociodemographic characteristics: This study included 98 participants with an equal sex distribution. The majority were aged 20–30 years (39.8%), followed by 31–40 years (32.7%). Most participants were from the internal medicine department (67.3%), with subspecialties such as general internal medicine (27.6%), endocrinology (10.2%), and pulmonology (9.2%). Professional levels included 48.0% consultants, 34.7% residents, and 12.2% fellows. Approximately half (49.0%) had ≤ 5 years of experience, while 16.3% had > 20 years of experience [Table 1].

Practices regarding glucocorticoid prescription the majority (70.4%) reported seeing 1–5 patients on glucocorticoids per week, while 11.2% saw none. Respiratory diseases were the most frequently treated with corticosteroids (75.3%), followed by allergic and immunological diseases (55.9%), and rheumatological diseases (49.5%). Most participants (68.4%) prescribed corticosteroids less than twice daily, with 27.6% always using GIOP prevention guidelines and 5.1% never using them [Table 2].

Knowledge of GIOP The majority (46.9%) strongly agreed that GIOP is an important clinical problem. Participants showed good understanding of GIOP-related thresholds, with 58.2% identifying a dose > 2.5–5 mg/day of prednisone as a threshold for preventive treatment. Additionally, 34.7% recognized that GIOP risk increases rapidly within the first 3–6 months of treatment. Most participants identified smoking (89.8%), alcohol consumption (< 3 daily units) (82.7%), high BMI (70.4%), and a sedentary lifestyle (84.7%) as contributing factors. Participants exhibited strong knowledge regarding fracture risk assessment and treatment options. Many identified the need for initial fracture risk assessment within six months (55.1%) and recognized high-risk criteria, including history of osteoporotic fracture (85.7%), BMD T-score ≤ -2.5 at the hip or spine (66.3%), FRAX 10-year risk of major fracture ≥ 10% (50.0%), FRAX 10-year risk of hip fracture ≥ 5% (30.6%), and high glucocorticoid dose ≥ 30 mg/day of prednisone (75.5%). Participants demonstrated good understanding of GIOP treatment and prevention options, with high rates of correct identification of therapies, including oral bisphosphonate (91.8%), IV bisphosphonate (51.0%), teriparatide (45.9%), denosumab (66.3%), and raloxifene (21.4%). Additionally, 64.3% recognized zoledronic acid as an alternative for those with gastrointestinal disorders who have difficulty using oral bisphosphonates [Table 3].

Table 2. Practices regarding glucocorticoid prescription

		N	%
The number of patients seen using glucocorticoids in your practice per week:	1–5	69	70.4%
	>10	12	12.2%
	none	11	11.2%
	5–10	6	6.1%
Conditions for which you prescribe corticosteroids frequently:	Respiratory diseases	70	75.3%
	Allergic and immunological diseases	52	55.9%
	Rheumatological diseases	46	49.5%
	Dermatological diseases	35	37.6%
	Endocrinological diseases	31	33.3%
	Infectious diseases	19	20.4%
	Oncological diseases	14	15.1%
Frequency of daily corticosteroid prescription on average:	< 2/day	67	68.4%
	>10/day	5	5.1%
	2–5/day	16	16.3%
	5–10/day	10	10.2%
How often do you use any glucocorticoid-induced osteoporosis prevention guidelines in your practice	Always	27	27.6%
	Never	5	5.1%
	Often	29	29.6%
	Rarely	17	17.3%
	Sometimes	20	20.4%

Table 3. Knowledge of glucocorticoid-induced osteoporosis (GIOP)

Knowledge Questions		N	%
1. In your opinion, GIOP is an important clinical problem:	Agree*	36	36.7%
	Disagree	1	1.0%
	Neither agree nor disagree	6	6.1%
	Strongly agree*	46	46.9%
	Strongly disagree	9	9.2%
	Correct Answer	82	83.7%
2. A dose greater than 2.5–5 mg/day of prednisone or its equivalent with a 3-month minimum duration is proposed as a threshold for preventive treatment:	False	20	20.4%
	True*	57	58.2%
	Uncertain	21	21.4%
	Correct Answer	57	58.2%
3. The risk of GIOP increases rapidly after months of commencement of GC treatment:	> 6 months	28	28.6%
	1–3 months	20	20.4%
	3–6 months*	34	34.7%
	Uncertain	16	16.3%
	Correct Answer	34	34.7%
4. What would you recommend as an optimal daily dose of calcium for GIOP prevention (from all sources)?	1000–1200 mg/day*	49	50.0%
	600–800 mg/day	20	20.4%
	800–1000 mg/day	16	16.3%
	Uncertain	13	13.3%
	Correct Answer	49	50.0%
5. Which of the following dosage of vitamin D is recommended for preventing and treating GIOP?	400–600 IU/day	8	8.2%
	600–800 IU/day*	15	15.3%
	800–1000 IU/day	63	64.3%
	Uncertain	12	12.2%
	Correct Answer	15	15.3%
6. Which of the following modifiable lifestyle factors contribute to GIOP? (Check all that applies)	Smoking*	88	89.8%
	Alcohol consumption (<3 daily units) *	81	82.7%
	High BMI*	69	70.4%
	Sedentary lifestyle*	83	84.7%
7. Which one of the following physical exercises are recommended for the prevention and treatment of GIOP?	Aerobic and anaerobic exercises	15	15.3%
	Balancing and mind-body exercises	4	4.1%
	Regular weight-bearing or resistance training exercises*	79	80.6%
	Correct Answer	79	80.6%
8. Initial fracture risk assessment using FRAX tool and BMD testing should be done in all adult patients or those aged ≥40 years on GC from initial therapy:	Within 6 months*	54	55.1%
	Within 9 months	7	7.1%
	Within one year	37	37.8%
	Correct Answer	54	55.1%
9. The following criteria/s put the patient into the high-risk group for GIOP:	History of osteoporotic fracture*	84	85.7%
	BMD T-score of < or = -2.5 at the hip or spine*	65	66.3%
	FRAX (GC-adjusted) 10-year risk for Major OP fracture >/= to 10%*	49	50.0%
	FRAX (GC-adjusted) 10-year risk for hip fracture >/= to 5%*	30	30.6%
	High dose of GC (>/= to 30 mg /day of prednisone or its equivalent) *	74	75.5%
10. Which of the following therapies could be used in GIOP treatment and prevention?	Oral bisphosphonate*	90	91.8%
	IV Bisphosphonate*	50	51.0%
	Teriparatide*	45	45.9%
	Denosumab*	65	66.3%
	Raloxifene*	21	21.4%
11. Zoledronic acid is an alternative for individuals with gastrointestinal disorders that make oral bisphosphonates difficult to use.	False	9	9.2%
	True*	63	64.3%
	Uncertain	26	26.5%
	Correct Answer	63	64.3%
12. Which of the following is considered a contraindication for Bisphosphonate use?	Chronic liver disease	2	2.0%
	CKD (eGFR <30 mL/min) *	79	80.6%
	Hypercalcemia	13	13.3%
	Paget's disease	4	4.1%
	Correct Answer	79	80.6%

*Correct Answer Abbreviations: BMI, body mass index; GC, glucocorticoid; GIOP, glucocorticoid-induced osteoporosis; BMD, bone mineral density; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate

Table 4. Barriers in the use of antiresorptive therapy in glucocorticoid-induced osteoporosis

In your opinion, what could be the barriers to the use of antiresorptive therapy in GIOP	Agree		Disagree		Neither agree nor disagree		Strongly agree		Strongly disagree	
	N	%	N	%	N	%	N	%	N	%
1. It is often the responsibility of another doctor (e.g., specialist or general practitioner, vice versa).	40	40.8%	16	16.3%	19	19.4%	12	12.2%	11	11.2%
2. Many patients cease therapy for osteoporosis prevention/treatment due to adverse effects.	52	53.1%	15	15.3%	20	20.4%	10	10.2%	1	1.0%
3. Difficulty in prescribing more medications to patients on multiple medications.	53	54.1%	19	19.4%	13	13.3%	12	12.2%	1	1.0%
4. Patients are concerned about adverse effects of anti-osteoporosis medications.	58	59.2%	15	15.3%	15	15.3%	10	10.2%	0	0.0%
5. Bisphosphonates have complex intake instructions, causing non-adherence.	53	54.1%	8	8.2%	18	18.4%	17	17.3%	2	2.0%
6. A lack of interest by the patient in osteoporosis prevention.	35	35.7%	24	24.5%	17	17.3%	16	16.3%	6	6.1%
7. There is lack of time to discuss GIOP with the patient.	41	41.8%	24	24.5%	18	18.4%	15	15.3%	0	0.0%
8. My knowledge of the current GIOP guidelines is insufficient.	36	36.7%	21	21.4%	25	25.5%	11	11.2%	5	5.1%
9. The safety of the available medications could be better.	40	40.8%	13	13.3%	34	34.7%	9	9.2%	2	2.0%
10. There are often contraindications to therapy.	38	38.8%	28	28.6%	19	19.4%	11	11.2%	2	2.0%
11. The existing guidelines are difficult to translate into practice.	15	15.3%	41	41.8%	28	28.6%	6	6.1%	8	8.2%

Abbreviations: GIOP, glucocorticoid-induced osteoporosis

Barriers to the use of antiresorptive therapy in GIOP Prominent challenges included patients discontinuing therapy due to concerns about adverse effects (53.1%). Healthcare providers faced difficulties prescribing additional medications to patients already on multiple drugs (54.1%). Complex intake instructions for bisphosphonates contributed to non-adherence (54.1%), and time constraints limited discussions about GIOP with patients (41.8%). Some healthcare professionals believed they had insufficient knowledge of GIOP guidelines (36.7%), with concerns about medication safety (40.8%) and contraindications to therapy (38.8%). There was also a perception that existing guidelines are challenging to implement in practice (41.8%) [Table 4].

Factors associated with knowledge of GIOP Knowledge scores were higher in female participants than males, with no significant difference (15.0 [IQR: 12.0–17.0] vs. 14.0 [IQR: 12.0–18.0]; P=.732). Individuals aged 31–40 years had the highest median knowledge score of 16.0 (IQR: 13.0–18.0), with no significant difference between age groups (P=.142). There was a significant difference in GIOP knowledge between family medicine specialists and internal medicine specialists, with the former scoring lower (14.0 [IQR: 11.0–16.0] vs. 15.0 [IQR: 12.0–18.0]; P=.043). Within internal medicine, significant differences in knowledge scores were found (P<.001), with cardiology specialists scoring lowest (12.0 [IQR: 12.0–12.0]) and infectious disease specialists and endocrinologists scoring highest (19.5 [IQR: 18.5–20.5] and 19.0 [IQR: 17.0–20.0], respectively). Consultants had higher median knowledge scores (16.0 [IQR: 13.0–18.0]) than fellows, residents, and interns (P=.012). Years of experience significantly impacted knowledge (P<.001), with those having > 20 years of experience scoring higher than those with ≤ 5 years (19.0 [IQR: 18.0–20.0] vs. 14.0 [IQR: 11.0–15.0]) [Table 5].

Participants who prescribed corticosteroids less than twice daily had higher median knowledge scores than those prescribing more frequently (15.0 [IQR: 12.0–18.0] vs. 9.0 [IQR: 8.0–13.0]), with a significant difference (P= .031). There were no significant differences in knowledge scores based on the number of patients seen using glucocorticoids per week or the conditions for which corticosteroids were frequently prescribed [Table 6].

DISCUSSION

This study assessed healthcare providers' knowledge, attitude, and self-reported practices regarding GIOP. Most participants worked in internal medicine and frequently encountered patients on continuous glucocorticoid therapy. The majority reported seeing one to five patients using glucocorticoids weekly, highlighting GIOP's relevance in clinical practice. Respiratory diseases were the most common conditions for corticosteroid prescriptions, indicating a need for vigilance in GIOP prevention among this patient group[19]. However, only 27.6% reported using GIOP prevention guidelines, suggesting a gap in consistent application of preventive measures[20].

A significant majority (46.9%) strongly agreed that GIOP is a clinical problem, aligning with the consensus in the field[21]. Participants demonstrated good awareness of GIOP-related thresholds, with 58.2% identifying the dose range for prednisone or its equivalent that necessitates preventive treatment. This level of understanding is crucial for timely interventions to mitigate GIOP risk[22]. A substantial proportion recognized lifestyle factors contributing to GIOP, such as smoking, alcohol consumption, high BMI, and a sedentary lifestyle, underscoring their awareness of modifiable risk factors[23,24].

Participants displayed strong knowledge regarding fracture risk assessment and treatment options. Many correctly identified the importance of initial fracture risk assessment within six months (55.1%) and criteria for identifying high-risk groups, including history of osteoporotic fracture (85.7%) and specific BMD T-scores[25]. Furthermore, participants exhibited good understanding of GIOP treatment and prevention options, correctly identifying various therapies, including oral bisphosphonate (91.8%), IV bisphosphonate

Table 5. Association of sociodemographic/professional factors with knowledge of GIOP

Sociodemographic factor		Knowledge score		
		Median	IQR	P value*,†
Sex	Female	15.0	12.0–17.0	0.732
	Male	14.0	12.0–18.0	
Age (years)	20–30	14.0	12.0–16.0	0.142
	31–40	16.0	13.0–18.0	
	41–50	15.0	10.0–18.0	
	>50	14.5	11.0–17.0	
Specialty	Family medicine	14.0	11.0–16.0	0.043*
	Internal medicine	15.0	12.0–18.0	
If it is internal medicine, write your subspecialty	Cardiology	12.0	12.0–12.0	<0.001*
	Endocrinology	19.0	17.0–20.0	
	Gastroenterology	14.0	10.0–17.0	
	General internal medicine	14.0	12.0–16.0	
	Immunology	11.0	11.0–11.0	
	Infectious disease	19.5	18.5–20.5	
	Nephrology	18.0	8.0–18.0	
	Oncology	13.0	11.0–15.0	
	Pulmonology	13.0	12.0–15.0	
	Rheumatology	17.5	14.0–18.0	
Professional level	Consultant	16.0	13.0–18.0	0.012*
	Fellow	13.5	11.5–16.5	
	House officer / Intern	11.0	11.0–11.0	
	Registrar or senior registrar	16.5	12.0–18.5	
	Resident	14.0	11.0–16.0	
Years of experience since graduation (years)	11–15	15.0	11.5–17.5	<0.001*
	16–20	14.0	14.0–15.0	
	≤5	14.0	11.0–15.0	
	6–10	16.0	13.0–17.0	
	>20	19.0	18.0–20.0	

*p<0.05, Significant
*Independent Samples Mann–Whitney U Test
*Independent Samples Kruskal–Wallis Test Abbreviation: IQR, interquartile range; GIOP, glucocorticoid-induced osteoporosis

Table 6. Association of practices regarding glucocorticoid prescription with knowledge of GIOP

Practice questions		Knowledge score		
		Median	IQR	P value†
Number of patients seen using glucocorticoids in your practice per week:	1–5	15.0	12.0–17.0	0.170
	5–10	12.0	11.0–15.0	
	>10	16.5	14.5–18.0	
	none	14.0	11.0–15.0	
Conditions for which you prescribe corticosteroids frequently:	Dermatological diseases	15.0	12.0–16.0	0.217
	Allergic and immunological diseases	14.0	11.5–16.0	
	Respiratory diseases	15.0	12.0–17.0	
	Infectious diseases	16.0	14.0–19.0	
	Oncological diseases	14.5	12.0–16.0	
	Endocrinological diseases	16.0	13.0–17.0	
	Rheumatological diseases	15.5	13.0–17.0	
Frequency of daily corticosteroid prescription on average:	< 2/day	15.0	12.0–18.0	0.031*
	>10/day	9.0	8.0–13.0	
	2–5/day	15.5	12.0–17.0	
	5–10/day	13.0	11.0–16.0	

*p<0.05, Significant
†Independent Samples Kruskal–Wallis Test Abbreviations: GIOP, glucocorticoid-induced osteoporosis; IQR, interquartile range

(51.0%), teriparatide (45.9%), denosumab (66.3%), and raloxifene (21.4%). Additionally, 64.3% recognized zoledronic acid as an alternative for those with gastrointestinal disorders. Prominent challenges included patients discontinuing therapy due to concerns about adverse effects (53.1%),[26] and difficulties in prescribing additional medications to patients already on multiple drugs (54.1%)[27]. Complex intake instructions for bisphosphonates contributed to non-adherence (54.1%), and time constraints limited discussions about GIOP with patients (41.8%)[28]. Some healthcare professionals believed they had insufficient knowledge of GIOP guidelines (36.7%), with concerns about medication safety (40.8%) and contraindications to therapy (38.8%)[29]. The perception that existing guidelines are challenging to implement in practice (41.8%) suggests a need for practical, user-friendly guidelines[6].

Knowledge scores were higher in female participants than males, with no significant difference (15.0 [IQR: 12.0–17.0] vs. 14.0 [IQR: 12.0–18.0]; P=.732). Individuals aged 31–40 years had the highest median knowledge score of 16.0 (IQR: 13.0–18.0), with no significant difference between age groups (P=.142). There was a significant difference in GIOP knowledge between family medicine specialists and internal medicine specialists, with the former scoring lower (14.0 [IQR: 11.0–16.0] vs. 15.0 [IQR: 12.0–18.0]; P=.043).6 Within internal medicine, significant differences in knowledge scores were found (P<.001), with cardiology specialists scoring lowest (12.0 [IQR: 12.0–12.0]) and infectious disease specialists and endocrinologists scoring highest (19.5 [IQR: 18.5–20.5] and 19.0 [IQR: 17.0–20.0], respectively)[30]. Consultants had higher median knowledge scores (16.0 [IQR: 13.0–18.0]) than fellows, residents, and interns (P=.012)[31]. Years of experience significantly impacted knowledge (P<.001), with those having > 20 years of experience scoring higher than those with ≤ 5 years (19.0 [IQR: 18.0–20.0] vs. 14.0 [IQR: 11.0–15.0])[32].

Participants who prescribed corticosteroids less than twice daily had higher median knowledge scores than those prescribing more frequently (15.0 [IQR: 12.0–18.0] vs. 9.0 [IQR: 8.0–13.0]), with a significant difference (P=.031). There were no significant differences in knowledge scores based on the number of patients seen using glucocorticoids per week or the conditions for which corticosteroids were frequently prescribed[32].

This study had limitations. The cross-sectional design restricted our ability to establish causal relationships between knowledge, practice, and factors such as specialization or years of experience. The study relied on self-reported data, which may have introduced recall and social desirability biases. Additionally, the study was conducted at a single hospital, limiting the generalizability of the findings.

CONCLUSION

In conclusion, several barriers to antiresorptive therapy for GIOP have been identified, including concerns about adverse effects and complex medication regimens. This study highlights the importance of specialization, professional level, and years of experience on GIOP knowledge. To enhance GIOP prevention and management, healthcare institutions should consider targeted interventions to address these barriers and tailor educational efforts to the specific needs and levels of experience of healthcare workers. Future research should explore the impact of such interventions and their effectiveness in improving GIOP outcomes.

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