

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

نحوه بررسی سلامت استخوان‌ها در خانم ۵۸ ساله
مبتلا به دیابت در درمانگاه پزشکی خانواده

استاد راهنما: استاد زنده دل

ارائه دهنده: کارورز امیرحسین کارگرجدی

Chief Complaint

- Follow up diabetes

Present illness

- بیمار خانم 58 ساله مورد شناخته شده دیابت نوع 2 از 11 سال قبل که در حال حاضر تحت درمان خوراکی کنترل دیابت است. وی جهت بررسی مراقبتهای دوره‌ای دیابت مراجعه کرده است.

- Past medical history: 2 نوع دیابت
- Past surgical history : 10 yrs ago AUB هیستریکتومی به علت
- Drug history:
Zipmet 500+50 BD
Metformin 500 daily
Atorvastatin 20 daily
Metoprolol 47.5
- Allergy history: negative
- Family history: negative

- Weight : 79kg
- Height 153 cm
- BP 88 /114

Physical Exam

ضایعه پوستی، اکیموز، پورپورا و پتشی دیده نشد.

ملتحمه pale نیست. اسکلرایکتریک نیست.

تنفس قرینه است. و دیسترس تنفسی ندارد. سمع ریه‌ها نرمال است و صدای اضافه یا کاهش صدای یکطرفه ندارد.

در سمع S1 و S2 شنیده می‌شود و سوفلی مسموع نیست.

نبض اندام‌ها پر و قرینه است.

شکم قرینه است. کاپوت مدوزا وجود ندارد. در لمس شکم نرم است و تندرns، ریباند تندرns و گاردینگ وجود ندارد و توده‌ای احساس

نمی‌شود. دق شکم تیمپان است. هیپاتومگالی و اسپلنومگالی وجود ندارد.

- Potassium (K): 4.6
- Phosphate (P): 4.5
- Vitamin B12: 736
- Calcium (Ca): 9.8
- Ferritin: 116.94
- Vitamin D: 57.7
- WBC: 6.32
- RBC: 4.78
- Hb: 13.4
- MCV: 83.7
- PLT: 315
- TSH: 1.42

Cr: 1

Microalbuminuria: 6

Urine Cr: 73.16

ACR (mg/g): 8.2

AST (SGOT): 21

ALT (SGPT): 18

HA1c: 7.30

Chol: 132

LDL: 58

HDL: 60

Alb: 4.5

DEFINITIONS

- Osteoporosis is the reduction in bone strength, leading to a higher risk of fractures
- . The World Health Organization (WHO) defines it as a bone density 2.5 standard deviations (SDs) below the mean for young healthy adults of the same sex and race, also known as a T-score of -2.5 .
- Postmenopausal women with a T-score <-1.0 are considered to have low bone density and may be at increased risk.
- Over 50% of fractures in postmenopausal women, including hip fractures, occur in those with low bone density.
- Clinical assessment now includes calculating the 10-year risk of hip or major osteoporosis-related fracture based on bone mineral density (BMD), age, gender, and other clinical risk factors.
- Osteoporosis-related fractures are defined as fractures from trauma equal to or less than a fall from standing height, excluding fingers, toes, face

- تخمین زده میشود که تعداد 200 میلیون زن در دنیا مبتلا به پوکی استخوان باشند که تقریباً معادل یک مورد از هر ده زن 60 ساله، یک مورد از هر پنج زن 70 ساله، دو مورد از هر پنج زن 80 ساله و دو مورد از هر سه زن 90 ساله خواهد بود
- نتیجه ی یک مطالعه ی متاآنالیز، شیوع استئوپروز در ناحیه ی مهره های کمری را در جمعیت مردان 12 درصد و در جمعیت زنان یائسه 19 درصد گزارش کرده است.
- حدود 58 میلیون نفر در ایران مبتال به کمبود کلسیم هستند و مصرف لبنیات در کشور بسیار محدود است. 56 درصد از جمعیت کشور مبتلا به کمبود ویتامین دی هستند.

TABLE 411-1 Risk Factors for Osteoporosis Fracture

NONMODIFIABLE	POTENTIALLY MODIFIABLE
Personal history of fracture as an adult	Current cigarette smoking
History of fracture in first-degree relative	Estrogen deficiency
Female gender	Early menopause (<45 years) or bilateral ovariectomy
Advanced age	Prolonged premenstrual amenorrhea (>1 year)
White race	Poor nutrition especially low calcium and vitamin D intake
Dementia	Alcoholism
	Impaired eyesight despite adequate correction
	Recurrent falls
	Inadequate physical activity
	Poor health/frailty

DIAGNOSIS

- MEASUREMENT OF BONE MASS

TABLE 411-4 Indications for Bone Mineral Density Testing

- Women aged ≥ 65 and men aged ≥ 70 ; regardless of clinical risk factors
 - Younger postmenopausal women, women in the menopausal transition, and men aged from 50 to 69 with clinical risk factors for fracture
 - Adults who have a fracture at or after age 50
 - Adults with a condition (e.g., rheumatoid arthritis) or taking a medication (e.g., glucocorticoids at a daily dose >5 mg prednisone or equivalent for >3 months associated with low bone mass or bone loss
- The FRAX score incorporates risk factors (age, prior fracture, family history of hip fracture, low body weight, cigarette consumption, excessive alcohol use, steroid use, and rheumatoid arthritis) with BMD to assess the 10-year fracture probabilities

Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Country: **Iran**

Name/ID:

[About the risk factors](#)

Questionnaire:

1. Age (between 40 and 90 years) or Date of Birth

Age:

Date of Birth:

Y:

M:

D:

2. Sex

Male

Female

3. Weight (kg)

4. Height (cm)

5. Previous Fracture

No Yes

6. Parent Fractured Hip

No Yes

7. Current Smoking

No Yes

8. Glucocorticoids

No Yes

9. Rheumatoid arthritis

No Yes

10. Secondary osteoporosis

No Yes

11. Alcohol 3 or more units/day

No Yes

12. Femoral neck BMD (g/cm²)

Select BMD



Clear

Calculate



Weight Conversion

Pounds kg

Convert

Height Conversion

Inches cm

Convert

00277441

Individuals with fracture risk assessed since 1st June 2011

Age	The model accepts ages between 40 and 90 years. If ages below or above are entered, the programme will compute probabilities at 40 and 90 year, respectively.
Sex	Male or female. Enter as appropriate.
Weight	This should be entered in kg.
Height	This should be entered in cm.
Previous fracture	A previous fracture denotes more accurately a previous fracture in adult life occurring spontaneously, or a fracture arising from trauma which, in a healthy individual, would not have resulted in a fracture. Enter yes or no (see also notes on risk factors).
Parent fractured hip	This enquires for a history of hip fracture in the patient's mother or father. Enter yes or no.
Current smoking	Enter yes or no depending on whether the patient currently smokes tobacco (see also notes on risk factors).
Glucocorticoids	Enter yes if the patient is currently exposed to oral glucocorticoids or has been exposed to oral glucocorticoids for more than 3 months at a dose of prednisolone of 5mg daily or more (or equivalent doses of other glucocorticoids) (see also notes on risk factors).
Rheumatoid arthritis	Enter yes where the patient has a confirmed diagnosis of rheumatoid arthritis. Otherwise enter no (see also notes on risk factors).
Secondary osteoporosis	Enter yes if the patient has a disorder strongly associated with osteoporosis. These include type I (insulin dependent) diabetes, osteogenesis imperfecta in adults, untreated long-standing hyperthyroidism, hypogonadism or premature menopause (<45 years), chronic malnutrition, or malabsorption and chronic liver disease
Alcohol 3 or more units/day	Enter yes if the patient takes 3 or more units of alcohol daily. A unit of alcohol varies slightly in different countries from 8-10g of alcohol. This is equivalent to a standard glass of beer (285ml), a single measure of spirits (30ml), a medium-sized glass of wine (120ml), or 1 measure of an aperitif (60ml) (see also notes on risk factors).
Bone mineral density (BMD)	(BMD) Please select the make of DXA scanning equipment used and then enter the actual femoral neck BMD (in g/cm ²). Alternatively, enter the T-score based on the NHANES III female reference data. In patients without a BMD test, the field should be left blank (see also notes on risk factors) (provided by Oregon Osteoporosis Center).

MANAGEMENT

- management of acute fractures
- reduce the impact of modifiable risk (Glucocorticoid medication, thyroid hormone replacement, smoking cessation, adjustment of drugs causing orthostatic hypotension and sedation and nocturia (diuretics) and falling)
- Nutritional Recommendations (Vitamin D, Calcium, protein intakes, Magnesium, vitamin K)
- Exercise

TABLE 411-8 Elemental Calcium Content of Various Oral Calcium Preparations

CALCIUM PREPARATION	ELEMENTAL CALCIUM CONTENT
Calcium citrate	60 mg/300 mg
Calcium lactate	80 mg/600 mg
Calcium gluconate	40 mg/500 mg
Calcium carbonate	400 mg/g
Calcium carbonate + 5 µg vitamin D ₂ (OsCal 250)	250 mg/tablet
Calcium carbonate (Tums 500)	500 mg/tablet

For those with osteoporosis or those at risk of osteoporosis, 1000–2000 IU/d can usually maintain serum 25(OH)D above 30 ng/mL. Vitamin D supplementation by itself does not appear to reduce fracture risk, but the combination of adequate calcium intake and vitamin D does decrease fracture risk

PHARMACOLOGIC TREATMENT OF OSTEOPOROSIS

- Antiresorptive Agents (Estrogens)
- Raloxifene
- Bisphosphonates
- Parathyroid Hormone
- stimulate bone formation (Abaloparatide)
- selective estrogen receptor modulators, and denosumab

ADA 2025

- Assess fracture risk in older adults with diabetes as a part of **routine care** in diabetes clinical practice, according to risk factors and comorbidities
- Monitor bone mineral density using DXA scan in older adults with diabetes (aged >65 years) and (>50 years) in individuals with multiple risk factors like insulin or duration >10 yrs every 2–3 years.
- Avoiding glucose lowering medications with a known association with higher fracture risk (e.g., thiazolidinediones and sulfonylureas) doubling the risk and benefit discontinuing
- Dppp4 inhibitors and GLP-1 Ras have shown neutral in trials
- Reduce the risk of falls and fractures in the glycemic management goals

- ❑ Age-specific fracture risk is significantly increased in people with type 1 or type 2 diabetes in both sexes, with a 34% increase in fracture risk compared with those without diabetes.
- ❑ type 2 diabetes, even with normal or higher BMD, hip fracture risk is increased by 1.79 times, and risk throughout life is 40–70% higher
- ❑ an 8% increased fracture risk per 1% rise in HbA1C level

- ❑ a T-score -2.0 should be interpreted as equivalent to -2.5 in a person without diabetes because FRAX doesn't factor DM2

ADA Management

- Appropriate glycemic management and minimizing hypoglycemic episode (poor vision, neuropathy)
- Advise people with diabetes on their intake of calcium (1,000– 1,200 mg/day) and vitamin D (20–30 ng/mL) 600 IU =51–70 yrs and 800 IU >70 yrs
- Antiresorptive medications and osteoanabolic agents should be recommended for older adults with diabetes(T-score <-2.0 or FRAX >3% for hip fracture and >20% major fracture)
- Aerobic and weight-bearing exercise

Table 4.4—Diagnostic assessment

Individuals who should receive BMD testing

People aged ≥ 65 years

Postmenopausal women and men aged ≥ 50 years with history of adult-age fracture or with diabetes-specific risk factors:

- Frequent hypoglycemic events
 - Diabetes duration > 10 years
 - Diabetes medications: insulin, thiazolidinediones, sulfonylureas
 - A1C $> 8\%$
 - Peripheral or autonomic neuropathy, retinopathy, nephropathy
 - Frequent falls
 - Glucocorticoid use
-

Patient ID: 0051686627 Ethnicity: Caucasian Height: 153.0 cm
 Referring Provider: Date of Birth: 1/1/1966 Weight: 79.0 kg

Name: NOORI, MASOUMEH
 Patient ID: 0051686627
 DOB: 01 January 1966

Sex: Female
 Ethnicity: Caucasian
 Menopause Age: 45
 Weight: 79.0 kg
 Age: 58

Referring Physician:

Indication: UNAPPROVED postmenopausal; screening for osteoporosis; secondary osteoporosis;

Accession number:

Bone Density: Exam date 9/16/2024

Region	BMD (g/cm ²)	T-score	Z-score	Classification
AP Spine(L1-L4)	0.713	-3.0	-1.7	Osteoporosis
Femoral Neck(Left)	0.626	-2.0	-0.8	Osteopenia
Total Hip(Left)	0.966	0.2	1.1	Normal
Total Forearm(Left)	0.423	-2.9	-1.7	
1/3 Forearm(Left)	0.512	-3.0	-1.8	
UD Forearm(Left)	0.313	-2.2	-1.4	

World Health Organization criteria for BMD Impression classify patients as Normal (T-score at or above -1.0), Osteopenia (T-score between -1.0 and -2.5), or Osteoporosis (T-score at or below -2.5)



10-year Fracture Risk¹:

Major Osteoporotic Fracture	8.3%
Hip Fracture	0.9%

Reported Risk Factors:

US (Caucasian), T-score(WHO)=-1.9, BMI=33.7, secondary osteoporosis

¹ FRAX® Version 3.08. Fracture probability calculated for an untreated patient. Fracture probability may be lower if the patient has received treatment.

Impression: UNAPPROVED The patient has osteoporosis, based on the Total Spine T-score. The patient has an estimated ten-year risk of hip fracture of 0.9% and an estimated ten-year risk of major fracture of 8.3%, based on the WHO FRAX algorithm.

Scan Information:

Scan Date: 16 September 2024 ID: A0916240I
 Scan Type: f Lumbar Spine
 Analysis: 16 September 2024 14:10 Version 13.6.0.4
 Spine

Operator:
 Model: Horizon Wi (S/N 201097)
 Comment:

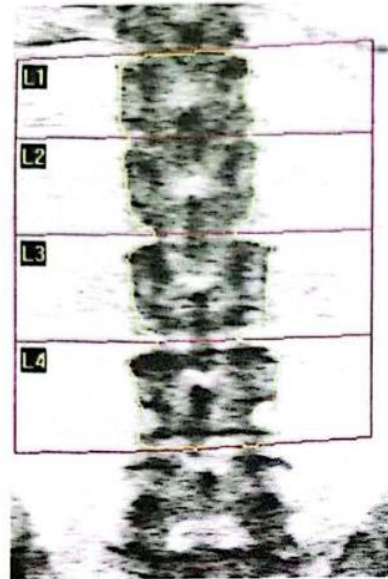


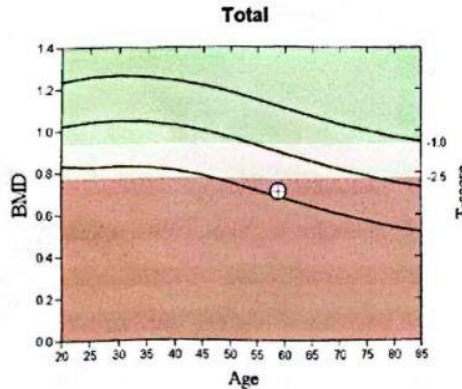
Image not for diagnostic use
 116 x 133

DXA Results Summary:

Region	Area (cm ²)	BMC (g)	BMD (g/cm ²)	T-score	PR (%)	Z-score	AM (%)
L1	11.55	8.09	0.700	-2.6	71	-1.5	81
L2	12.77	8.84	0.692	-3.1	67	-1.8	78
L3	14.34	10.07	0.702	-3.5	65	-2.1	75
L4	14.80	11.10	0.750	-2.8	71	-1.4	83
Total	53.46	38.10	0.713	-3.0	68	-1.7	79

Total BMD CV 1.0%

WHO Classification: Osteoporosis
 Fracture Risk: High



Comment:

T-score vs. White Female. Source: 2012 BMDCS/Hologic Z-score vs. White Female. Source: 2012 BMDCS/Hologic

Name: NOORI, MASOOMEH
 Patient ID: 0051686627
 DOB: 01 January 1966

Sex: Female
 Ethnicity: Caucasian
 Menopause Age: 45

Height: 153.0 cm
 Weight: 79.0 kg
 Age: 58

Referring Physician:

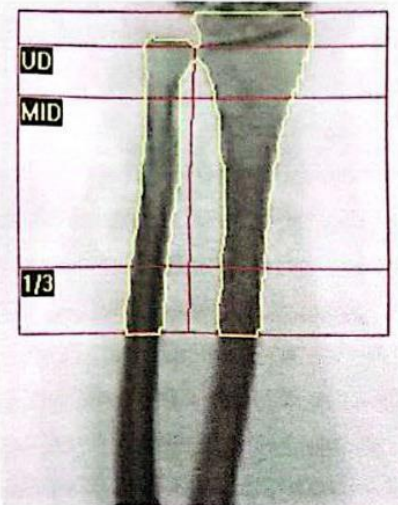


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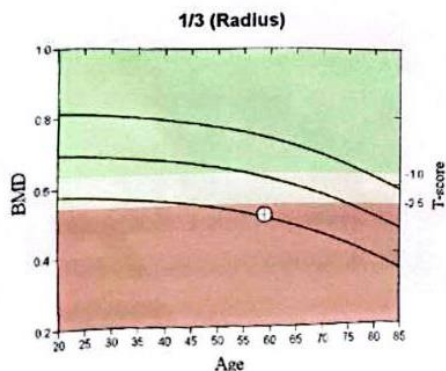
Scan Information:

Scan Date: 16 September 2024 ID: A0916240L
 Scan Type: a L.Forearm
 Analysis: 16 September 2024 14:09 Version 13.6.0.4
 Left Forearm
 Operator:
 Model: Horizon Wi (S/N 201097)
 Comment:

DXA Results Summary:

Radius	Area (cm ²)	BMC (g)	BMD (g/cm ³)	T-score	PR (%)	Z-score	AM (%)
UD	3.92	1.23	0.313	-2.2	71	-1.4	80
MID	6.64	3.04	0.457	-2.7	75	-1.5	84
1/3	2.33	1.19	0.512	-3.0	74	-1.8	82
Total	12.89	5.46	0.423	-2.9	73	-1.7	82

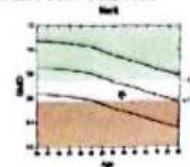
Total BMD CV 1.0%
 WHO Classification: Osteoporosis
 Fracture Risk: High



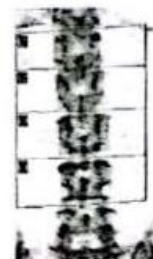
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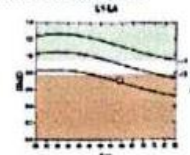
Scan Date: 16 September 2024
 Scan ID: A0916240K



Scan Type: f Left Hip



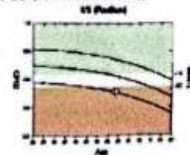
Scan Date: 16 September 2024
 Scan ID: A0916240I



Scan Type: f Lumbar Spine



Scan Date: 16 September 2024
 Scan ID: A0916240L



Scan Type: a L.Forearm

Results:

	BMD (g/cm ²)	T-score	PR (%)	Z-score	AM (%)
Left Hip (Neck)	0.626	-2.0	74	-0.8	88
Left Hip (Total)	0.966	0.2	103	1.1	116
Spine (Total)	0.713	-3.0	68	-1.7	79
Left Forearm (1/3)	0.512	-3.0	74	-1.8	82
Left Forearm (Total)	0.423	-2.9	73	-1.7	82
Total BMD CV 1%					

Summary:

	Classification
Left Hip BMD (Neck)	Osteopenia
Left Hip BMD (Total)	Normal
Spine BMD (Total)	Osteoporosis
Left Forearm BMD (1/3)	Osteoporosis
Left Forearm BMD (Total)	Osteoporosis

A spine fracture indicates 5X risk for subsequent spine fracture and 2X risk for subsequent hip fracture.

Referring Physician:

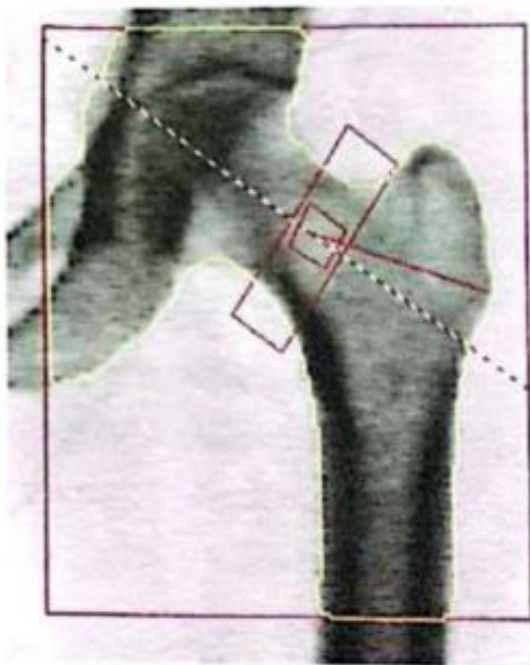


Image not for diagnostic use
110 x 127
NECK: 49 x 15

Scan Information:

Scan Date: 16 September 2024 ID: A0916240K

Scan Type: f Left Hip

Analysis: 16 September 2024 14:09 Version 13.6.0.4
Hip

Operator:

Model: Horizon Wi (S/N 201097)

Comment:

DXA Results Summary:

Region	Area (cm ²)	BMC (g)	BMD (g/cm ²)	T-score	PR (%)	Z-score	AM (%)
Neck	4.54	2.84	0.626	-2.0	74	-0.8	88
Troch	7.85	4.64	0.591	-1.1	84	-0.3	95
Inter	24.04	27.70	1.152	0.3	105	1.0	115
Total	36.44	35.18	0.966	0.2	103	1.1	116
Ward's	1.07	0.41	0.385	-3.0	52	-1.1	75

Total BMD CV 1.0%

WHO Classification: Osteopenia



FRAX[®] WHO Fracture Risk Assessment Tool

10-year Fracture Risk¹

Major Osteoporotic Fracture 8.3%

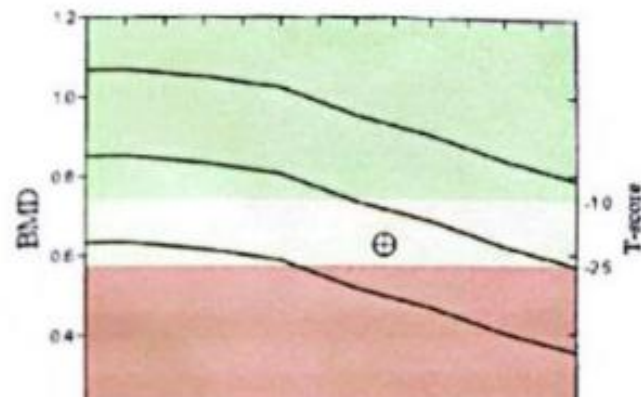
Hip Fracture 0.9%

Reported Risk Factors:

US (Caucasian), T-score(WHO)=-1.9, BMI=33.7, secondary osteoporosis

¹ FRAX[®] Version 3.08 Fracture probability calculated for an untreated patient. Fracture probability may be lower if the patient has received treatment.

Neck



سطوح پیشگیری

Primordial Prevention

Primary Prevention

Secondary Prevention

Tertiary Prevention

Quaternary Prevention

Primordial Prevention

- Encourage regular physical activity and weight-bearing exercises.
- Promote aerobic exercises to improve overall health and bone strength.
- Advocate for a balanced diet rich in calcium, vitamin D, and adequate protein and Discourage smoking and excessive alcohol and caffeine consumption prevent calcium loss from bones.
- Education and Counseling: informing diabetic patients Diabetic patients are at significant higher risk of bone fractures. Early intervention can significantly reduce the risk of osteoporosis.

Primary Prevention

- with a T-score < -2.0 consider initiation of a first-line drug, including bisphosphonates (alendronate, risedronate, and zoledronic acid) or denosumab
- Bisphosphonate therapy (oral or intravenous) may be more appropriate in individuals with poor medication-taking behavior or gaps in access to medical care

Secondary Prevention

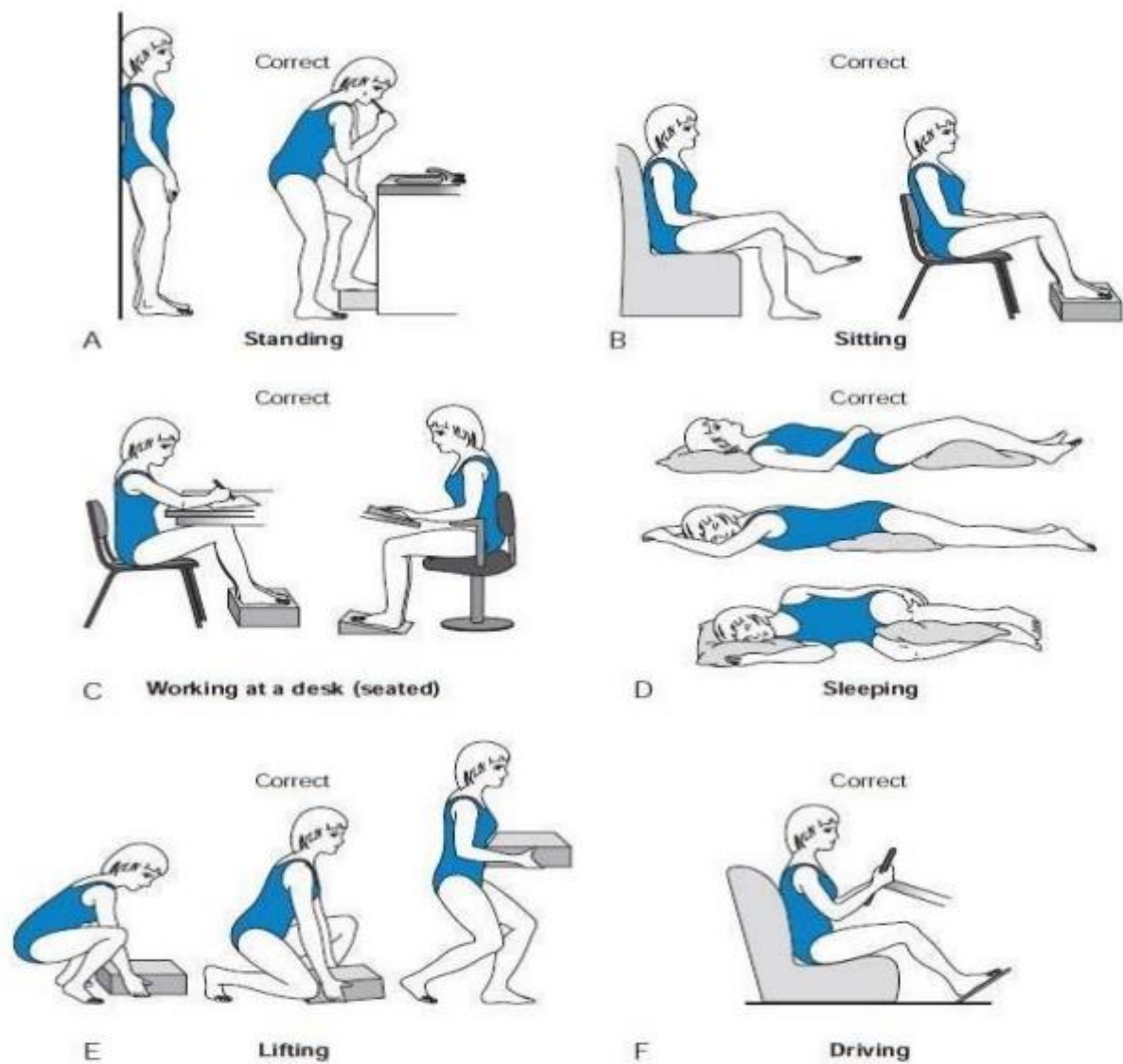
- Antiosteoporosis treatment reduces the risk of a subsequent fracture older individuals with prior hip or vertebral fracture in the first 1–2 years after
- people with diabetes who experience fragility fracture should be given the diagnosis of osteoporosis regardless of DXA data and receive the appropriate work-up
- Individuals on long-term treatment with antiosteoporosis medications, with multiple fragility fractures should be referred to a bone metabolic specialist

Tertiary Prevention

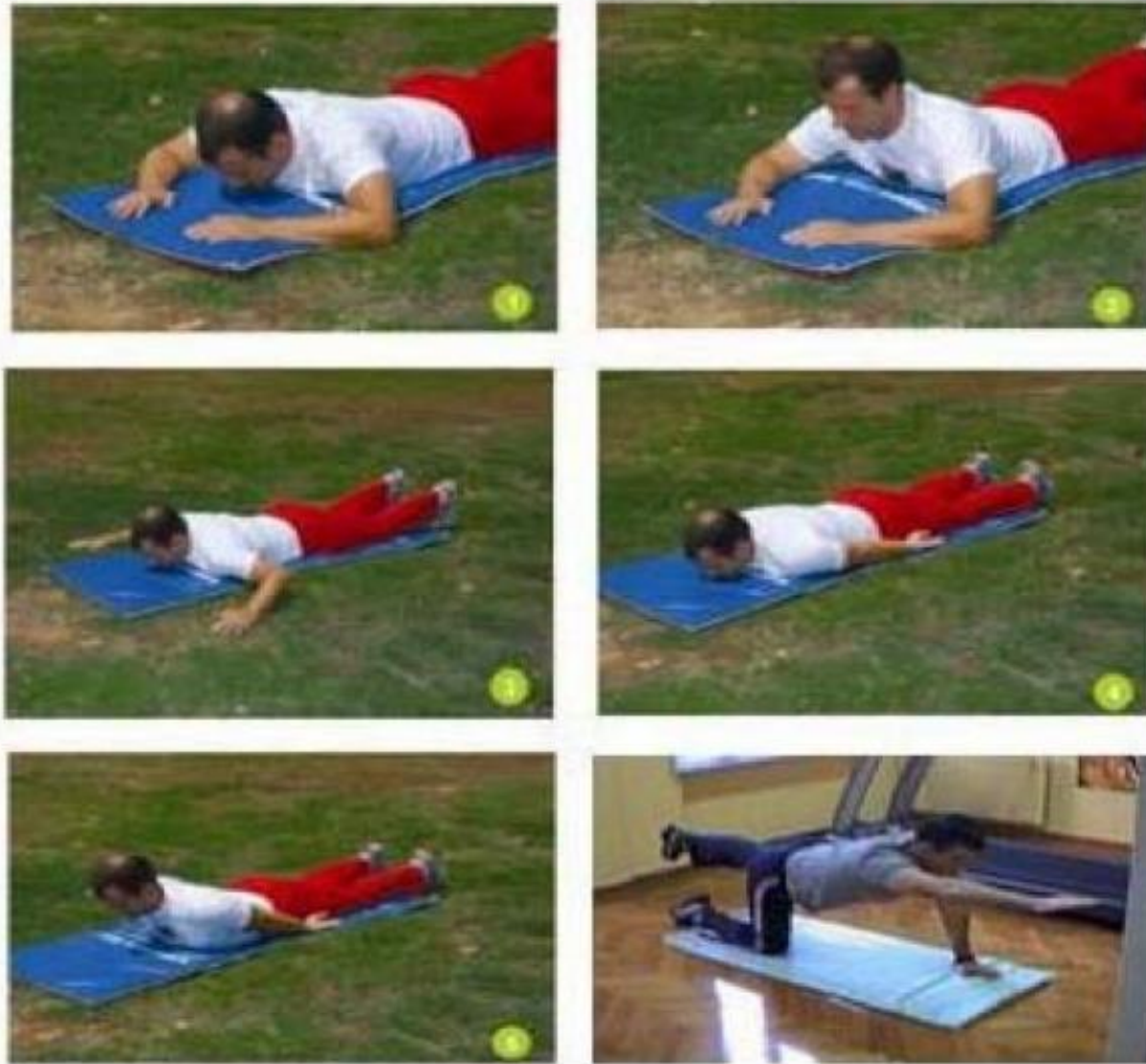
- Prescribe medications such as bisphosphonates,
- Regular bone density tests with reassessment every 2–3 years.
- Encourage physical therapy to improve balance and muscle strength, reducing the risk of falls.
- Teach patients proper fall prevention techniques and the importance of medication adherence.

Quaternary Prevention

- Avoid unnecessary diagnostic tests .
- Involve patients in decision-making to ensure treatments align with their values and preferences.
- Promote non-pharmacological approaches when appropriate, such as lifestyle modifications and physical activity.
- Because Diabetic patients may face a higher burden of medical interventions due to medications.



شکل ۱-۶: پوسچرهای درست استاتیک و دینامیک



شکل ۲-۶: تقویت عضلات پشت



شکل ۳-۶: شنا رفتن روی دیوار



شکل ۶-۶: تمرینهای تقویتی عضلات بازو با دمبل یا تراباند (کش پیلاتس)

postural exercises^{۴۷}



شکل ۷-۶: ورزش در بیماران مبتلا به استئوپروز برای اصلاح وضعیت بدنی

نقش پزشک خانواده

