Declaration

I do not have anything to declare as there is no professional, personal and/or material or monetary relationships with any industrial firms.

CLINICOPATHOLOGICAL SPECTRUM OF FRAGILITY HIP FRACTURES OBSERVED IN A DEVELOPING COUNTRY

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Introduction

- Fragility hip fracture is not an uncommon complication of age related degenerative changes in bone.
- Vitamin D deficiency (VDD) is highly prevalent among fragility hip fracture patients.
- Etiology- inadequate sunlight exposure,
  inadequate intake of calcium & vitamin D.
- Osteopenia/osteoporosis is a condition of weak bone, minor trauma may result in fracture.
- Diagnosis is done best by histomorphological examination of bone.

Terms used for a weak bone

- Osteomalacia – softening of bone due to demineralization.
- Osteoporosis - reduction in bone mass, bone → porous & brittle.
- Osteopenia - milder form of reduction in bone mass.
- Inevitable age related changes but preventable.
- U.S. National osteoporosis foundation anticipates (2015)
  - 1 in 2 white women >50 years with osteoporotic #.
  - incidence of hip #
    - 3 fold higher in osteopenia
    - 9 fold higher in osteoporosis.

Bone mineral density (BMD)

- measure of calcium in bone.
- Helps to estimate fracture risk.
- BMD level determines osteopenia or osteoporosis by plain X-ray or DEXA (dual energy x ray absorptiometry).
- Result is determined compared to healthy individual.
- BMD by DEXA : T-score

: -1 SD is considered normal.

: between -1 SD and -2.5 SD → osteopenia.

: ≤-2.5 SD → osteoporosis.

Aims and objectives

- to assess degree of osteopenia in fracture hips histologically.
- to correlate with clinical and biochemical parameters.

Material and methods

- Prospective study in patients attending services of Orthopaedic department.
- Patients admitted with clinical and radiological evidence of fragility hip fracture
- Study - July 2015 to June 2016
- Informed consents were obtained in all enrolled patients.

Inclusion Criteria	Exclusion Criteria
• Age >50 years.	• Age <50 years.
• Fragility fracture as the result of trivial trauma	• Fracture due to major trauma.
• Fracture site - neck of femur or intertrochanteric	• Pathological hip fracture; 2dary osteoporosis.
• T score < -2.5	• T score >-2.5

History recorded

- History and clinical examinations
- Patient assessment

  - details of fracture; risk factors, associated co-morbidities and nutritional habits, history of sun exposure.
- Past and family histories to rule out any congenital or genetic disorders.

Laboratory parameters

- Fasting venous blood samples in the first 24 hours of hospital admission.
- Biochemical parameters assessed

  - serum vit D, parathormone, Ca+, phosphorus, alk phosphatase, renal & liver function tests.
- BMD – by DEXA Scan before surgery.
- At surgery - bone biopsy of 5 to 10 mm size adjacent to fracture site.

Biopsy processing

- Biopsies were fixed in 10% buffered formalin overnight.
- All samples were processed without de-calcification.
- Histological examination

  - sections of 5 micron thick,

  - H&E, toluidine blue at ph 2.8, elastic von Gieson,

    Masson's trichrome.

- Normal control – amputation specimen of trauma.

Assessment of the bone

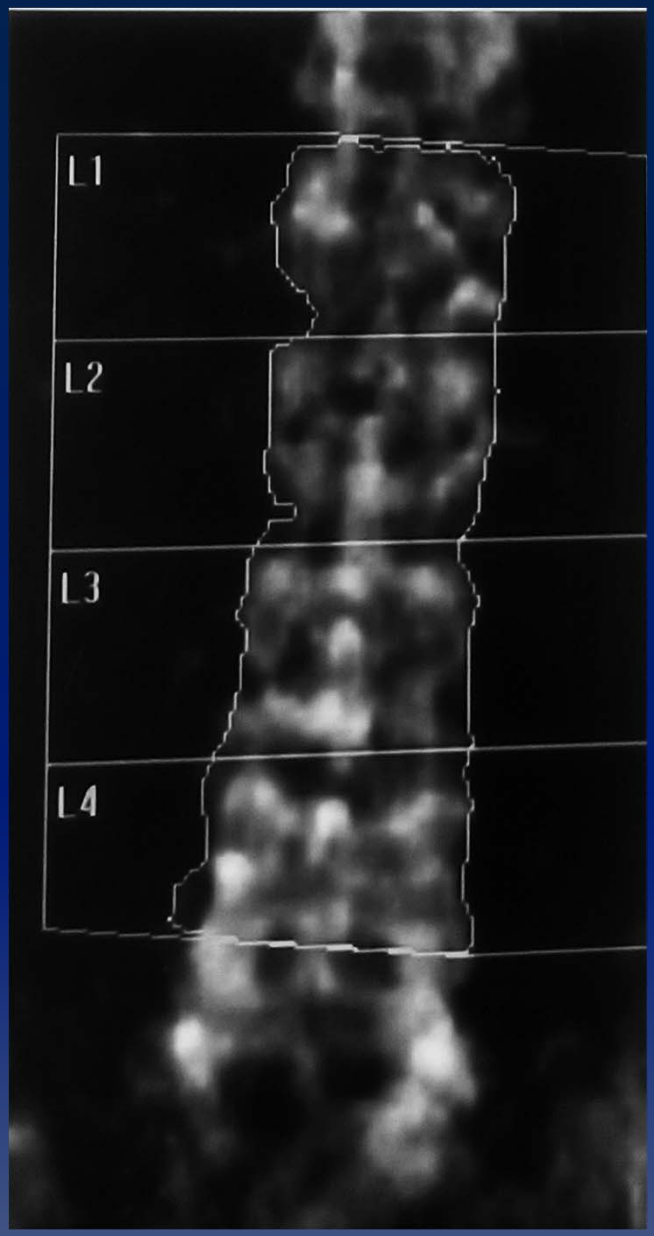
- Subjective and observational.
- Trabecular network under 10x lense.
- Presence or absence of unmineralized osteoid were graded.
- - mild, <1/3 of each trabeculae showing changes.
  - moderate, half of trabeculae involved.
  - severe, >half of trabeculae is involved.

RESULTS

Plain x-ray films

Intertrochanteric fracture

Fracture neck of femur



Scan Information:

Scan Date: 09 July 2015 ID: A0709150J
Scan Type: x Lumbar Spine
Analysis: 09 July 2015 11:49 Version 13.4.2:3
Spine
Operator:
Model: Discovery A (S/N 87292)
Comment:

DXA Results Summary:

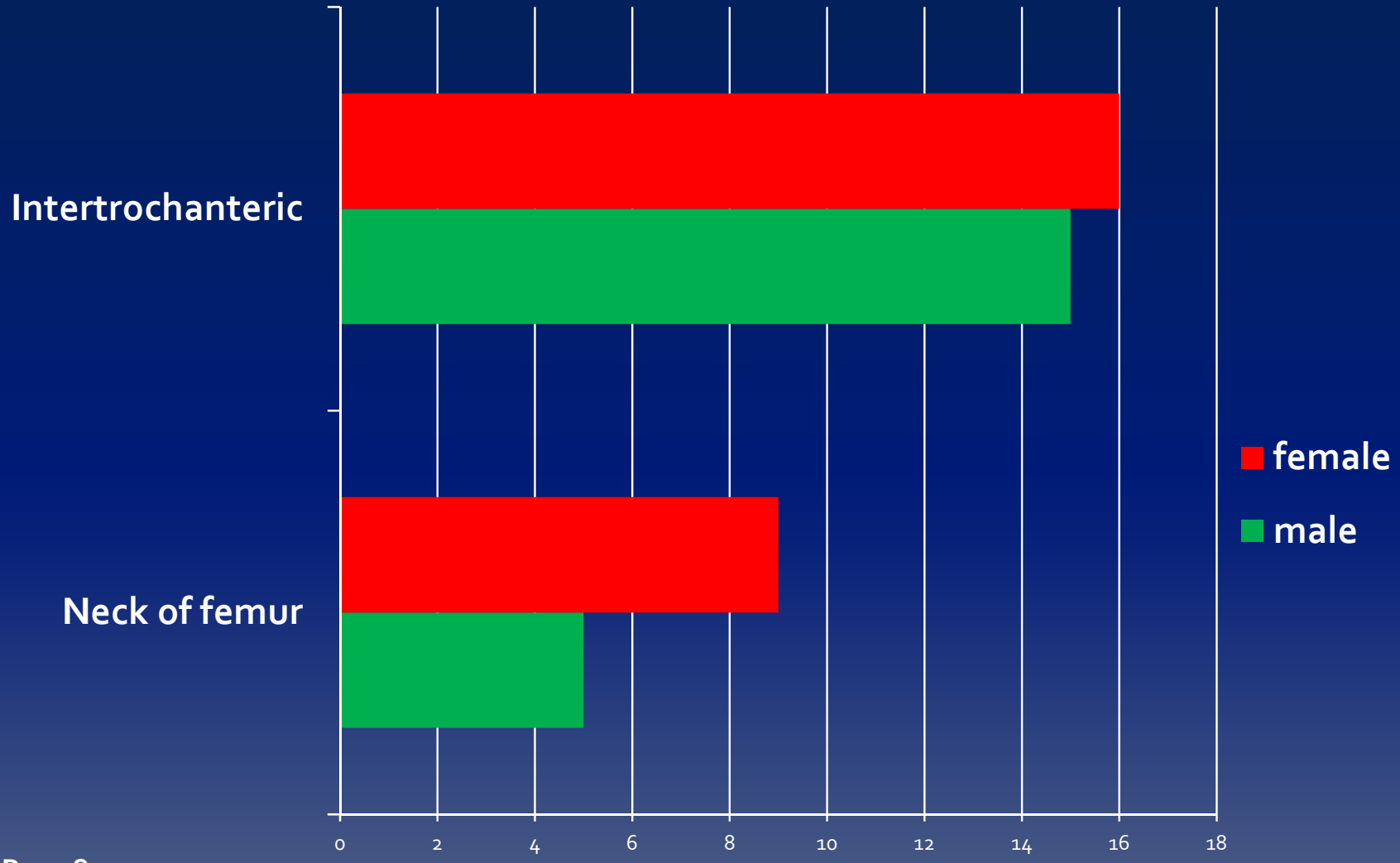
Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T-score	Z-score
L1	13.11	8.99	0.686	-3.5	-2.7
L2	14.02	10.33	0.737	-3.2	-2.4
L3	14.69	11.77	0.801	-2.7	-1.9
L4	15.73	13.58	0.863	-2.1	-1.2
Total	**57.56**	**44.67**	**0.776**	**-2.9**	**-2.0**

Patient detail

- Total number of patients: 45
- Female : male= 25:20.
- Mean age: 68.7 years; Range: 53- 85 years.
- Type of fractures
  - 31 (68.9%) inter-trochanteric
  - 14 (31.1%) neck femur fracture

Pre-injury mobility status

Sex distribution and fracture type



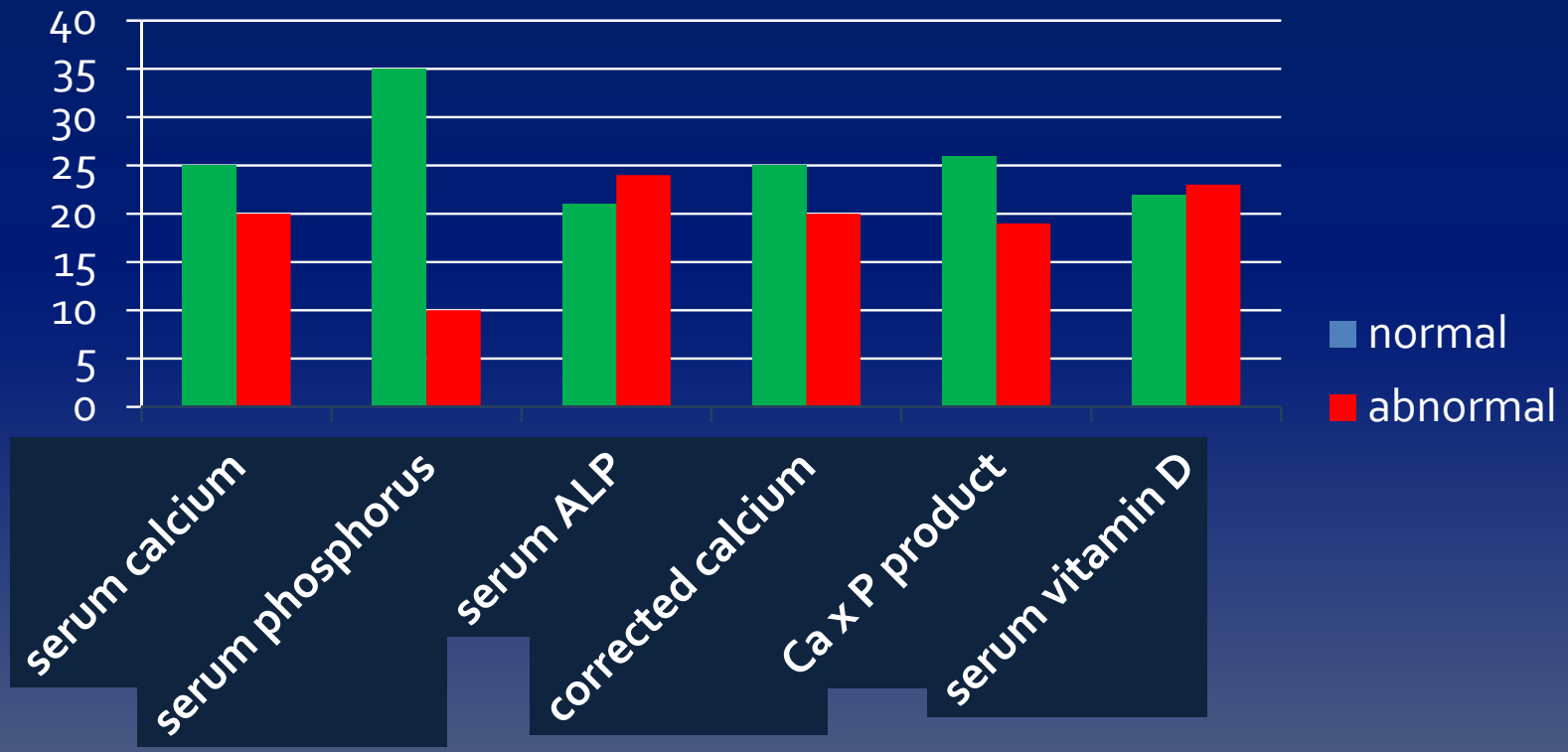
Personnel history

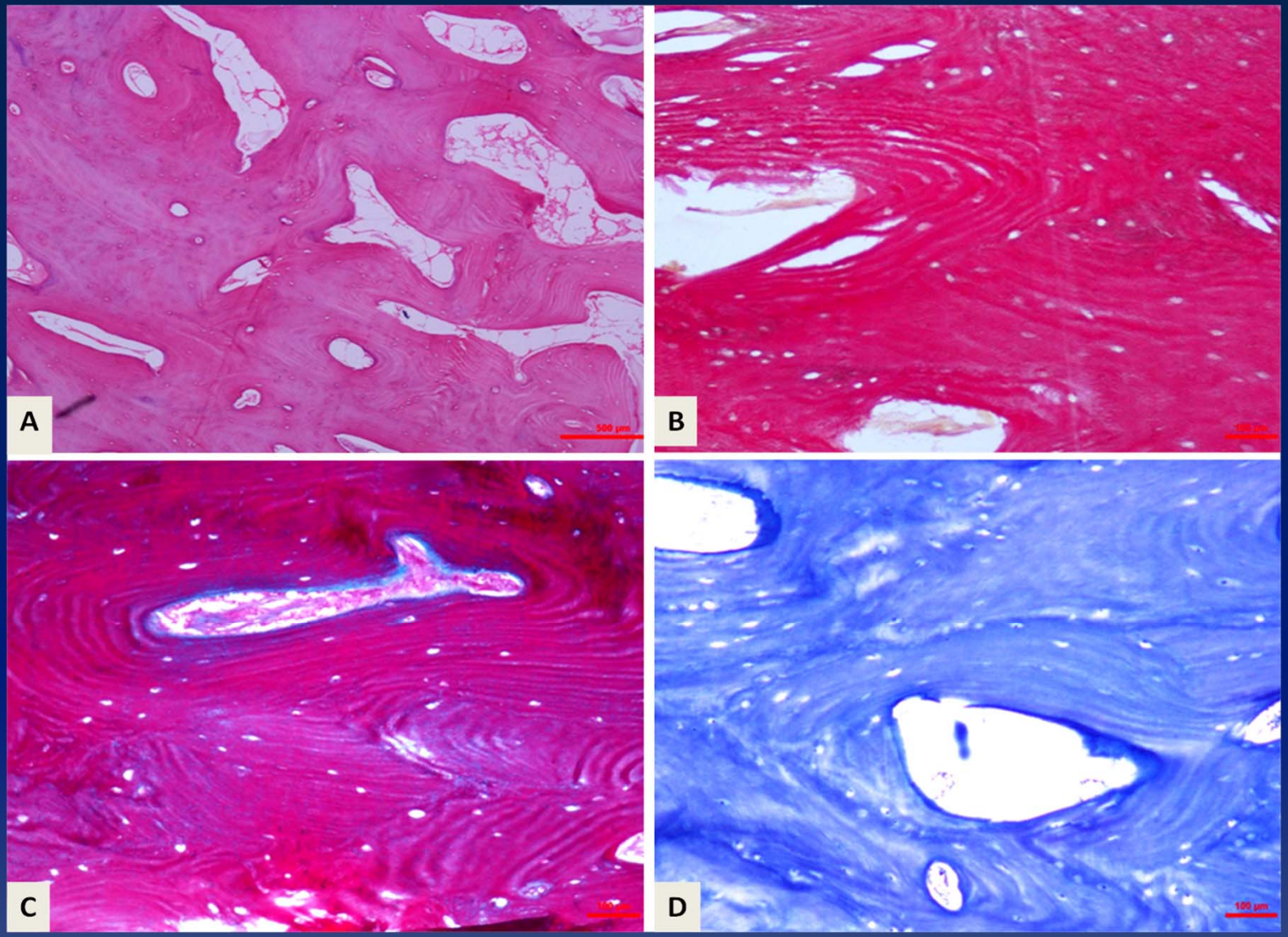
- Vegetarian -34(75.6%) & non-vegetarian - 11(24.4%).
- Smoker - 6(13%).
- regular or occasional alcohol - 9(20%).

Associated diseases	No. of patients
Hypertensive	21(46.7%)
Other cardiac problem	6(13.3%)
Diabetic	14(31%)
Hypertensive + diabetic	9(20%)
Hypertensive+ other cardiac	8(17.8%)
Urology problem	3(6.7%)

Biochemical parameters

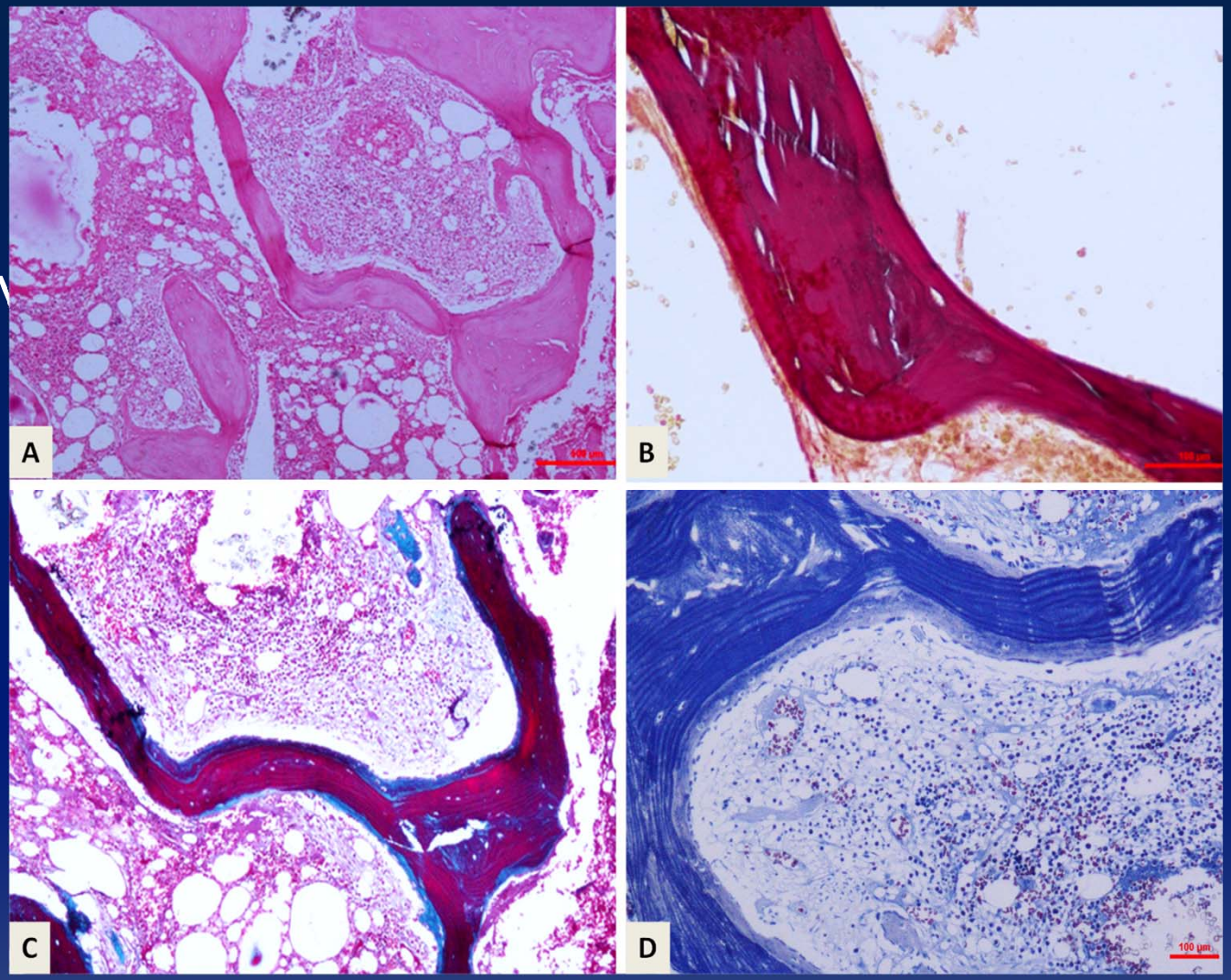
	Serum Ca+	Serum PO_4	Corrected Ca+	Serum ALP	Serum Vit D
Normal	25(55.6%)	35(77.8%)	25(55.6%)	21(46.7%)	22(48.9%)
Abnormal	20(44.4%)	10(22.2%)	20(44.4%)	24(53.3%)	23(51.1%)



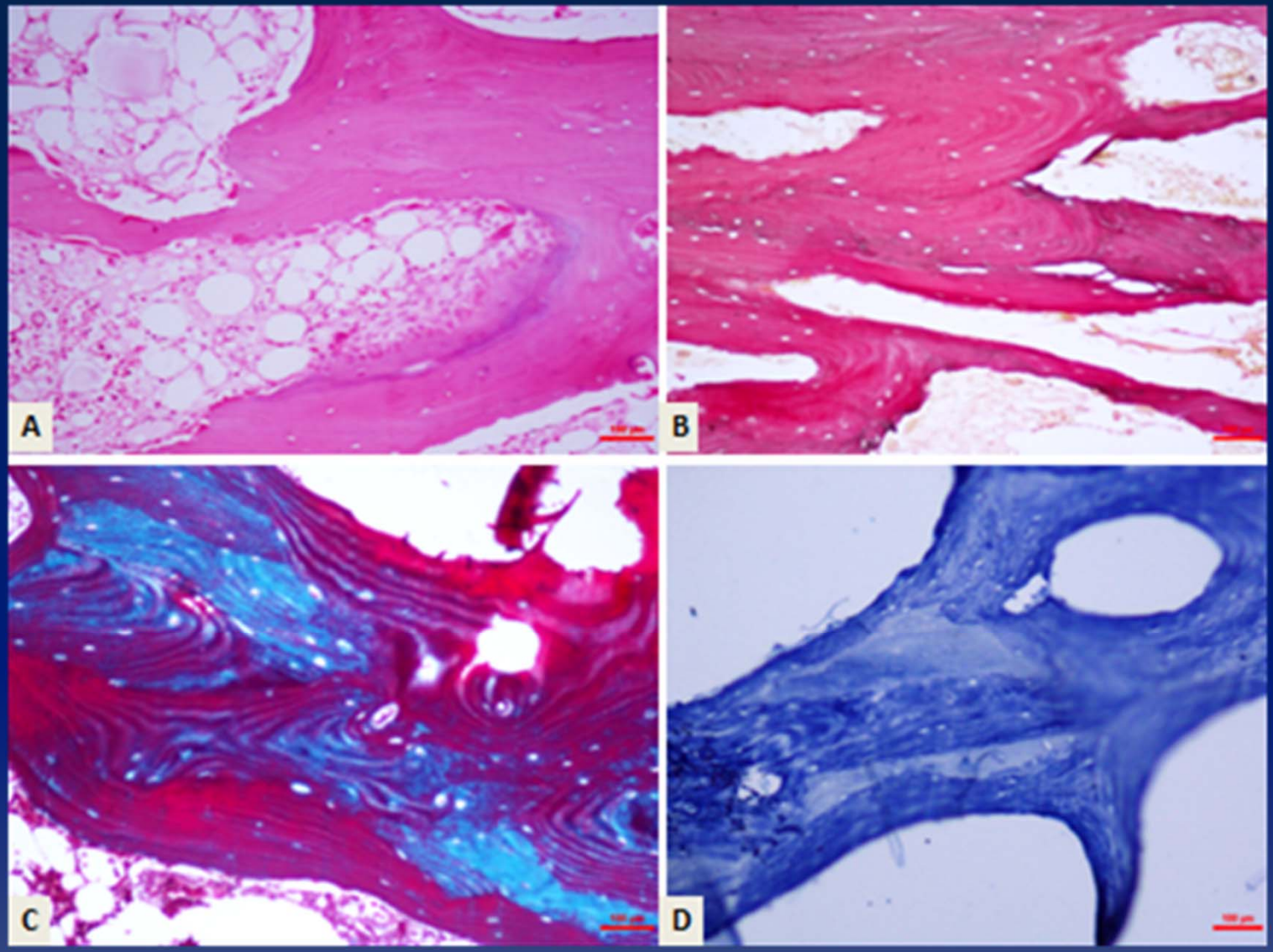


Normal bone in different stainings: Hematoxylene and eosin (A), Elastic Van Giesen (B), Masson' trichrome (C) and Solochrome cyanin (D).

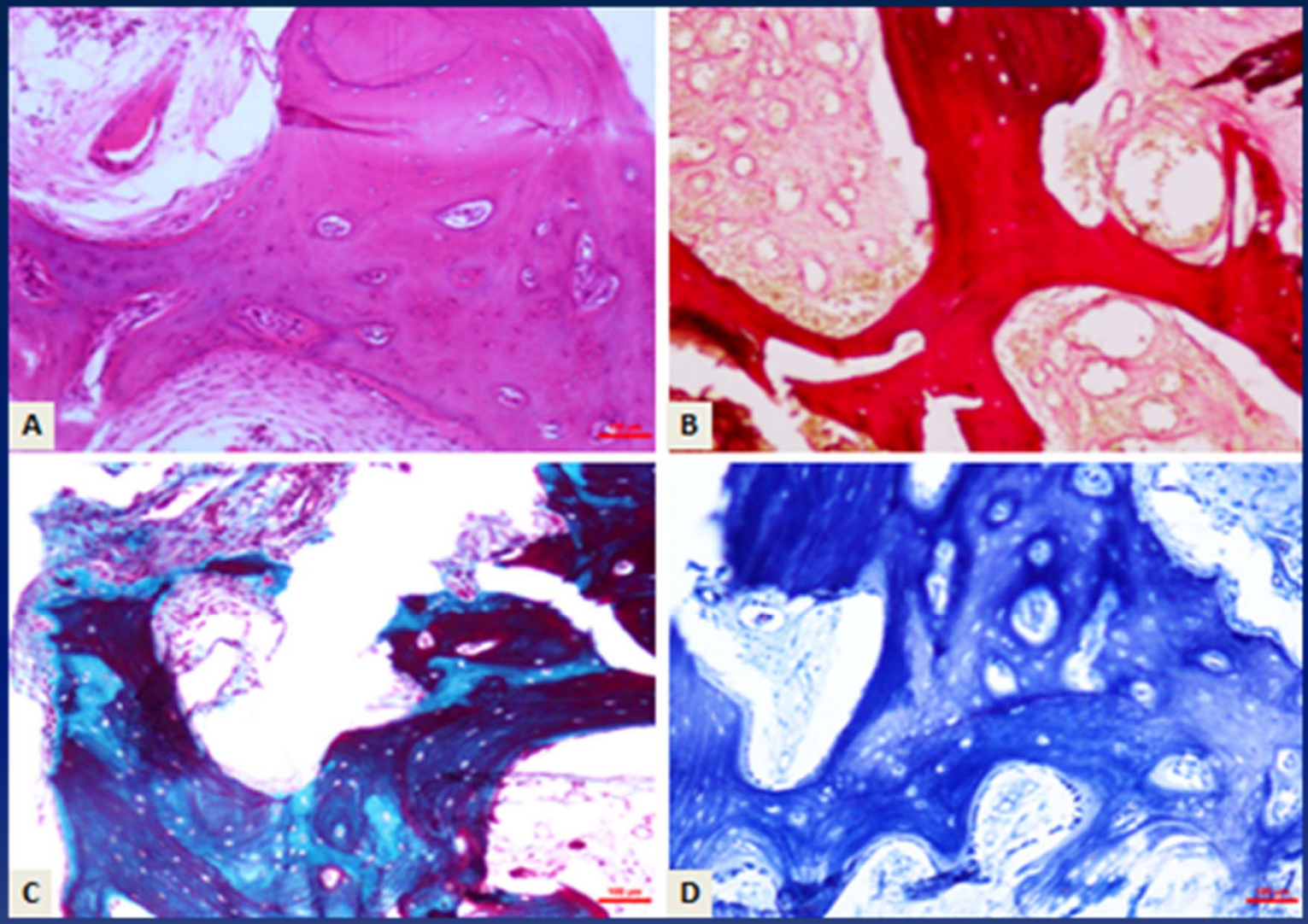
- M



Panel of photomicrographs showing mild degree osteopenia in 4 different stainings

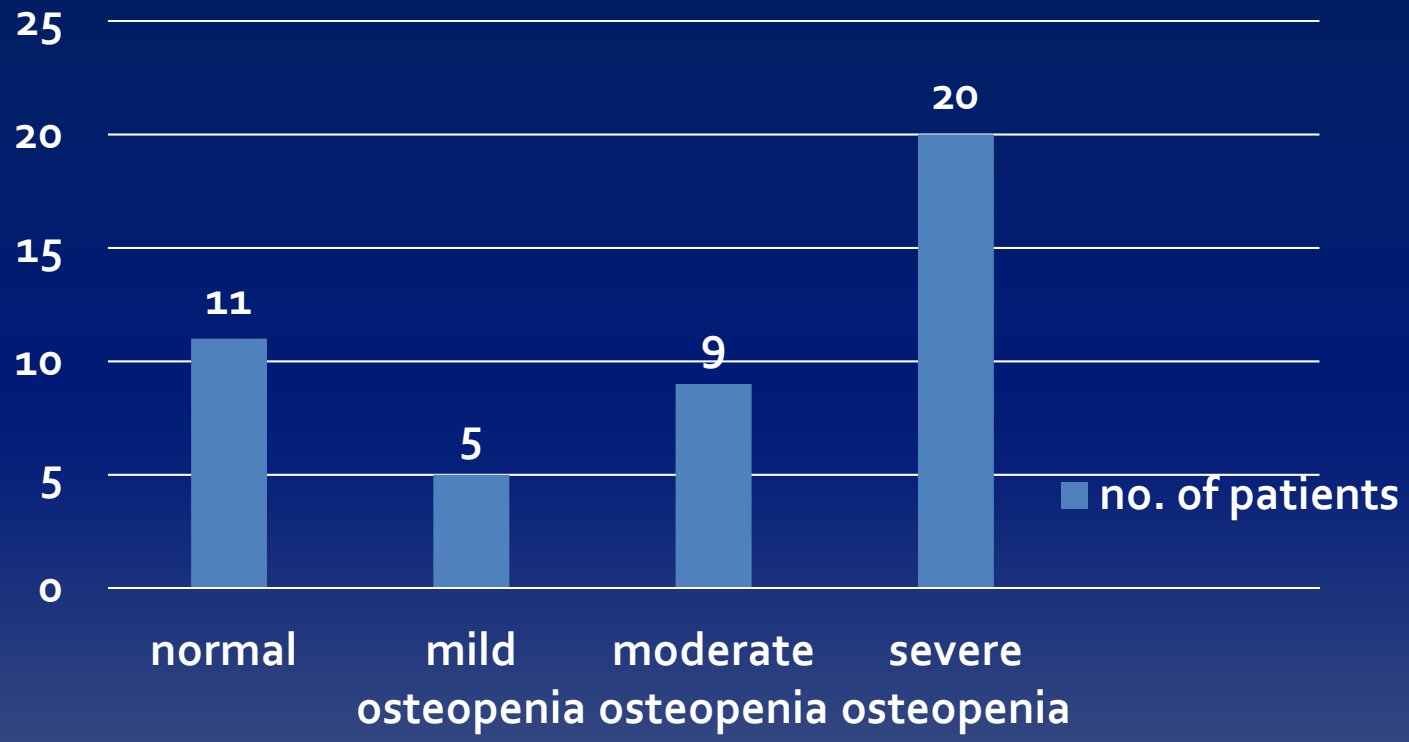


Panel of photomicrographs showing moderate degree osteopenia in 4 different stainings



Panel of photomicrographs showing severe degree osteopenia in 4 different stainings

No of cases with different grades of Osteopenia



Patient details

- 38/45 (84.4%) sustained fracture at home with fall/slip in the bathroom.
- wet floor as the cause of fall/slip in 34 (75.5%) patients.
- Only 19 patients (42.2%) had history adequate sunlight exposure (normal ~ 15 minutes per day)

Correlates of biochemical parameters with osteopenia

Variable	No. of patients		Osteopenia				p-value
			N=11	Mild=5	Mod = 9	Severe=20	
Serum Ca+	Normal	25	9	4	7	5	0.291
	Reduced	20	2	1	2	15	
Serum PO_4	Normal	32	10	4	8	10	1.000
	Reduce	13	1	0	1	10	
Serum ALP	Normal	20	8	4	2	6	0.085
	↑	25	3	1	7	14	
Corrected Ca+	Normal	25	9	4	7	5	0.499
	Reduced	20	2	1	2	15	
Serum Vit D	Normal	20	6	3	5	6	0.484
	Reduced	25	5	2	4	14	

Correlation of different variables and histopathology

Variables		No. of patients	Histopathology		p-value
			Normal	Osteopenia	
Dietary History	Vegetarian	32(78.1%)	6(14.6%)	26(63.4%)	0.042
	Non vegetarian	9(21.9%)	5(12.3%)	4(9.7%)	
Sex	Male	18(43.9%)	6(14.6%)	12(29.4%)	0.164
	Female	23(56.1%)	4(9.7%)	19(46.3%)	
Type of Fracture	Intertrochanteric	29(70.7%)	7(17.1%)	22(53.7%)	0.701
	Neck of femur	12(29.3%)	4(9.7%)	8(19.5%)	

CONCLUSIONS

- Vitamin D deficiency is highly prevalent among fragility hip fracture in the study population.
- Risk factors for Vit D deficiency are inadequate exposure to sunlight exposure and nature of diet intake.
- In suspected osteopenia, histopathology of bone biopsy is a helpful diagnostic tool, in addition to DEXA scan.
- Amongst the connective tissue staining, MT is of much help to identify uncalcified osteoid.