Bone properties of osteoporotic patients with femoral neck fractures

To the Editor: The most detrimental consequence of osteoporosis is the increased incidence of physical disability due to fractures, especially subcapital femur neck fractures. In all types of osteoporosis the earliest and most striking change occurs in trabecular bone, where the trabeculae become thin and sparse, with subsequent fracture. In hip osteo-arthritis, osteoporosis and femur neck fractures seldom occur. The question whether osteo-arthritic bone has different biochemical and biophysical qualities arises.

This study concerns the mechanical characteristics and biochemical composition of cancellous bone at the upper femoral region. Freshly excised femoral heads and femoral neck specimens were obtained from 100 patients, of whom 50 underwent total hip replacement for hip osteo-arthritis and 50 required a hip prosthesis for subcapital femur neck fracture. All patients were white, the age range was 60 - 80 years, and the female/male ratio was 2:1. The osteo-arthritis and fracture groups were absolutely comparable with regard to age and sex distribution. The following variables were examined: (i) the apparent density ($\rho = \frac{\text{mass}}{\text{volume}}$ g/cm^3) of the femoral heads and specimens were measured using the Archimedes principle;[1] (*ii*) hydroxyproline as an index of collagen and the calcium content were measured by spectrophotometry as described by Baily *et al.*[2,3], (*iii*) total bone mineral content was measured by using the computed tomography (CT) technique developed in our laboratory[4] — a Siemens Somatom II scanner was used at 96 kV and 125 kV respectively; and (*iv*) compressive stress, strain and modules of elasticity were measured as previously described[5] and correlated with the above results.

The mean values obtained for each group were as follows:

	Fracture group	*Osteo-arthritis group*
Specific gravity (femoral heads)	1,11 ± 0,07	1,21 ± 0,04
Specific gravity (biopsy specimens)	1,16 ± 0,04	1,33 ± 0,06
Collagen content (mg/cm^3 dry defatted bone)	100,55 ± 5	198,60 ± 6
Calcium content (mg/cm^3 dry defatted bone)	84 ± 9	177 ± 13
Mineral content (QCT-scanning) (g/t)	136 ± 32	183 ± 40
Compressive stress (mPa)	3,44 ± 1,73	9,24 ± 2,92
Modulus of elasticity	162 ± 80	398 ± 161

The collagen and calcium content as well as the mean bone mineral content were significantly lower in the fracture group than in the osteo-arthritic controls. Bone density was also significantly lower in both the specimens and the femoral heads of the fracture group than in the osteo-arthritis group. The fracture group needed only 37% of the compressive stress of the osteo-arthritis group to give way.

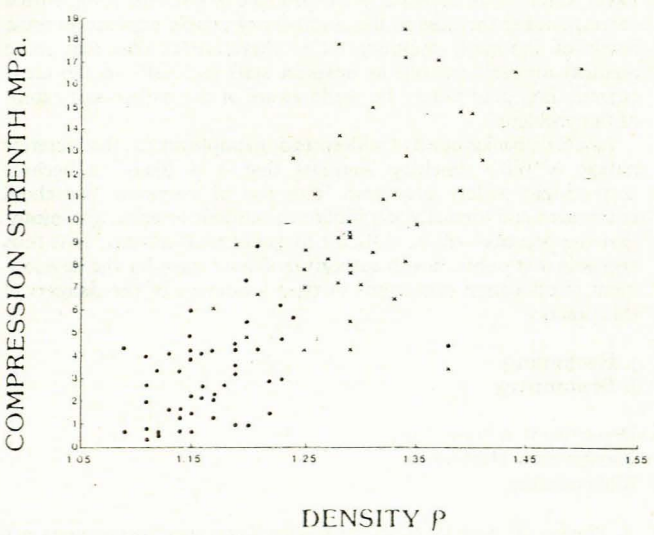

Fig. 1. Correlation of compression strength and relative density in the fracture and osteo-arthritis groups (• = fracture group; x = osteo-arthritis group).

Correlations of compression strength and relative density in the fracture and osteo-arthritis groups are depicted in Fig. 1.

A linear correlation between compression strength and relative density was obtained.

Several authors have shown a definite relationship between mechanical properties of cancellous bone and density.[6,7,8] Our results show that mechanical bone strength, and especially compressive strength of cancellous bone, is directly proportional to the density of bone, which in turn is a product of collagen content and mineralisation ($r = 0,62$ for the osteoarthritis group and 0,55 for the fracture group). The results show significantly higher values ($P < 0,001$) for bone strength, density and both collagen and mineral content in the osteo-arthritis group. This many explain why so few osteoporotic fractures occur in patients with osteo-arthritis and confirms the common clinical observation that patients with primary osteo-arthritis have a 'better quality' of bone.[9] They are less likely to be suffering from osteoporosis, which is considered the most important factor responsible for fragility of bone, and are therefore less prone to subcapital femur neck fractures.[10]

It appears that measurement of bone mineral content of the femur by CT may provide a useful tool in the diagnosis of osteopenic conditions such as osteoporosis. Femoral CT measurements provided an index of fracture risk by revealing a permissive bone mineral level of approximately 160 ± 36 g/l above which fractures are rare and below which fractures may occur.[4] Furthermore, below a bone mineral content of 136 ± 32 g/l fractures are the rule and absence of fratures is the exception.

This study demonstrates that in future mechanical and biochemical analysis of *in vitro* bone biopsies may help in the prevention of femur neck fracture in subjects at risk.

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1. Mueller K, Trias A, Ray RD. Bone density and composition. *J Bone Joint Surg [Am]* 1966; **48:** 140-148.
2. Baily P. The biochemistry of lungs in relation to silicosis. *Arch Biochem Biophys* 1960; **87:** 144-148.
3. Baily P, Kilroe-Smith TA, Harington JS. Biochemistry of lungs in relation to silicosis. *Arch Environ Health* 1964; **8:** 547-554.
4. Van Papendorp DH, Pistorius S, Hough FS. *In vitro* determination of bone mineral content of the femur neck. *S Afr Med J* 1988; **73:** 363-364.
5. Van Papendorp DH. Die meganies-fisiese eienskappe van die trabekulêre (kanselleuse) been van die femurnek. *S Afr Tydskr vir Natuurwetenskap en Tegnologie* 1986; **5:** 138-142.
6. Martens M, Van Audekerche R, Delport P, De Meester P, Muller JC. The mechanical characteristics of cancellous bone at the upper femoral region. *J Biomechanics* 1983; **16:** 971-983.
7. Leichter I. Margulies JY, Weinrib A *et al.* The relationship between bone density, mineral content and mechanical strength in the femoral neck. *Clin Orthop* 1982; **163:** 272-281.
8. Lindahl O, Lindgren GH. Cortical bone in man: variation of the amount and density with age and sex. *Acta Orthop Scand* 1967; **38:** 133-140.
9. Weintroub S, Papo J, Ashkenagi M, Tardiman R, Weissman SL, Salama R. Osteo-arthritis of the hip and fractures of the proximal end of the femur. *Acta Orthop Scand* 1982; **53:** 261-264.
10. Solomon L. The femoral trabecular pattern in patients with osteo-arthritis and those with fractures of the femoral neck. *J Bone Joint Surg [Br]* 1979; **61:** 257.

Spontaneous kidney rupture in polyarteritis nodosa presenting as an acute abdomen

To the Editor: An acute abdomen in a patient with polyarteritis nodosa (PAN) is a perplexing and challenging problem for both the physician and the surgeon.[1] The diagnosis of PAN may not have been established before gastro-intestinal complications develop.[2]

A 27-year-old man was admitted to our ward with a 3-week history of fever, myalgia and subcutaneous nodules on the elbow, left ear and scalp. He had mononeuritis of the right leg and epididymitis. Test-strip analysis of the urine showed haematuria 2+ and microscopy showed red blood cells and granular casts. The erythrocyte sedimentation rate was 110 mm/1st h (Westergren) and the white cell count 25 x 10^9/l. Serum urea and creatinine values were normal. Testing for hepatitis B surface antigen was positive. On day 3 the patient developed an acute abdomen. Laparotomy revealed a large haematoma in the epigastric area, as well as a large retroperitoneal haematoma. Biopsy material from a mesenteric mass was compatible with PAN. Treatment was started with prednisone 60 mg/d and cyclophosphamide 100 mg/d. Forty days after admission an acute abdomen developed once again. An ultrasound scan showed a large hypo-echoic mass posterolateral to the left kidney, displacing it anteriorly (Fig. 1). Despite intensive resuscitation the patient died. Autopsy revealed that the lower pole of the left kidney had ruptured, with a large fresh peri-renal haematoma. There were also multiple small infarcts of the liver and both kidneys.

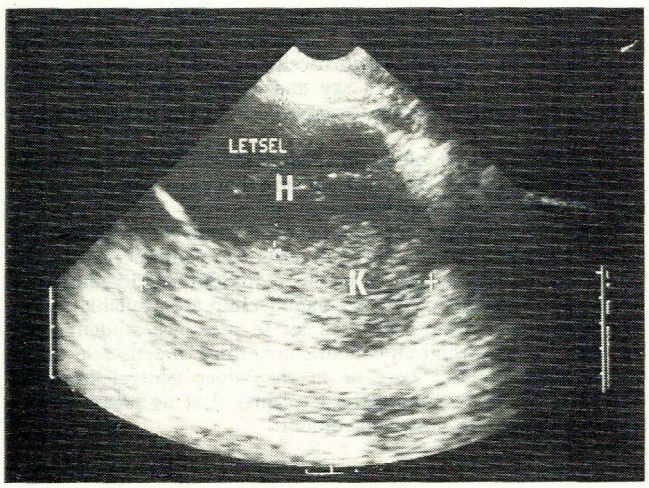

Fig. 1. Ultrasound scan showing haematoma posterolateral to the left kidney, displacing it anteriorly (K = kidney; H = haematoma).

This patient demonstrated renal and liver complications of PAN culminating in death due to spontaneous kidney rupture. This is a rare complication that may be due to rupture of an intraparenchymal aneurysm. Other renal complications include multiple segmental renal infarcts, renovascular hypertension and rupture after renal biopsy. Without a high index of suspicion, spontaneous peri-renal haematoma may not be diagnosed before surgery or even autopsy. Early diagnosis and properly timed surgery may decrease the high mortality rate in this condition.[3] Ultrasonography and computed tomography may help in the diagnosis.

Kidney rupture with peri-renal haematoma should be considered in patients with PAN presenting with an acute abdomen.

We thank Dr A. Shulman for doing the ultrasonography.

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1. Matolo NM, Dominic A. Gastrointestinal complications of collagen vascular diseases — surgical implications. *Am J Surg* 1971; **122:** 678-682.
2. Zizic TM, Classen JN, Stevens MB. Acute abdominal complications of systemic lupus erythematosus and polyarteritis nodosa. *Am J Med* 1982; **73:** 525-531.
3. Cornfield JZ, Johnson ML, Dolehide J, Fowler E. Massive renal hemorrhage owing to polyarteritis nodosa. *J Urol* 1988; **140:** 808-809.

Naloxone in opiate-induced colonic pseudo-obstruction

To the Editor: An otherwise healthy man presented to a casualty department after 2 days of treatment for diarrhoea with loperamide (Imodium), codeine and Kantrexil, with severe cramping peri-and subumbilical pain of increasing severity.

He was obviously distressed and was sweating, with tachycardia but no fever. His abdomen was rigid and tender maximally in the subumbilical region, while bowel sounds were increased.

A radiograph of the abdomen revealed gas-filled loops of large bowel with nothing else abnormal. A full blood count was normal.

A diagnosis of colonic pseudo-obstruction with compensatory small-bowel hyperperistalsis was made, the underlying cause being bowel opiate receptor stimulation by codeine and loperamide.

An intravenous line was established and naloxone 0,4 mg intravenous and 0,2 mg intramuscular injections were given. Within 2 minutes the patient experienced a marked decrease in the severity of the abdominal cramps; shortly thereafter felt well enough to discharge himself from the casualty department. Flatus was passed later that day, while a normal bowel action followed a day later. There was no recurrence of abdominal cramps, constipation or diarrhoea during the following week.

It is possible that naloxone could be used effectively in treating opiate (codeine, loperamide and diphenoxylate)-induced constipation or pseudo-obstruction instead of or in combination with more conservative 'drip and suck' management.

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Findings on computed tomography of the chest in lymphangiomyomatosis

To the Editor: A 54-year-old white woman presented with a 10-year history of insidious increasing exertional dyspnoea. Clinical examination at the most recent visit had revealed a few rales in the left base, which cleared with deep breathing. Lung function tests showed relatively normal lung volumes but associated reduction in the diffusing capacity at approximately 50% of predicted value. Radiographs revealed a long-standing diffuse interstitial pattern of unknown causation with slow progression over a period of 10 years (Fig. 1, A).

Computed tomography (CT) demonstrated multiple thin-walled cysts, less than 20 mm in diameter, scattered at random in

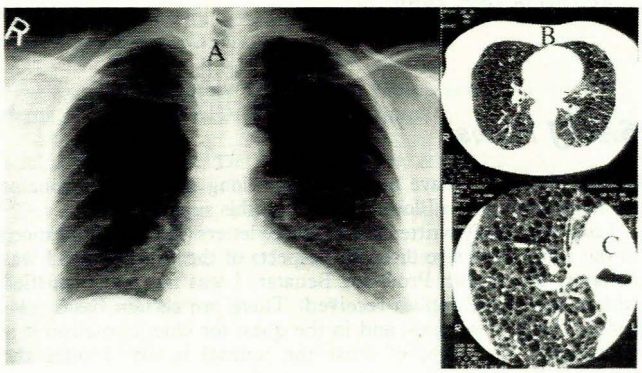

Fig. 1. A — frontal radiograph demonstrating a nonspecific interstitial pattern throughout both lungs; B — thin-section CT; and C — magnified portion showing multiple thin-walled cysts scattered randomly throughout both lungs. Lung tissue between the cysts appears normal.