IGF-1 levels, leg extensor power and physical performance after proximal femoral fracture

SIR—Elderly survivors of proximal femoral fracture (PFF) are often left with long-term disability associated with poor muscle function. A potentially reversible factor in this poor outcome is impairment of the growth hormone/insulin-like growth factor 1 (IGF-1) axis. Ageing is associated with a decrease in activity of this hormone system. IGF-1 mediates the anabolic action of growth hormone resulting in protein sparing. IGF-1 levels are associated with measures of muscle power in healthy elderly females [1]. Hip fracture patients have low IGF-1 levels [2]; however, it is not known whether low levels of IGF-1 are associated with reduced muscle power after PFF. We studied elderly patients rehabilitating after PFF, hypothesising that patients with lower circulating IGF-1 levels would have reduced muscle power and poorer physical performance.

Thirteen patients (12 of them female) admitted to the Geriatric Orthopaedic Rehabilitation Unit, between 7 and 21 days after surgical fixation for proximal femoral fracture, were studied at baseline and after 6 weeks of rehabilitation. No specific interventions were undertaken to modify IGF-1 levels. Exclusion criteria were significant cognitive impairment (abbreviated mental test score <7/10), a known terminal illness or a medical illness too severe to allow informed consent for inclusion. After overnight fasting blood samples were taken and stored on ice. Within 30 minutes of venepuncture they were centrifuged (4°C) at 3000 rpm for 20 minutes. Serum was then stored at −26°C until analysis for IGF-1 (performed using an in-house radioimmunoassay, after formic acid-acetone extraction, as previously described [3]). Age related reference ranges were established in the same laboratory using serum derived from 150 healthy blood
donors. The inter- and intra-assay coefficients of variation were less than 10%. Leg extensor power (LEP) was measured using the Nottingham Power Rig. The 20 point Barthel Index and Elderly Mobility Scale were also recorded as measures of disability and functional mobility respectively.

The median age was 79 years (IQR 73.0–86.5). The median IGF-1 level at baseline was 120.0 (92.0–129.5) ng/ml and at 6 weeks was 108.5 (100.2–119.7) ng/ml, Wilcoxon Signed Ranks test P = 0.41. The lower end of the reference range for 60–70 year olds is 108 ng/ml using this assay. There were no significant correlations between baseline measures of IGF-1 and LEP. At 6 weeks, however, IGF-1 levels correlated with LEP (Figure 1) in both fractured and non-fractured legs (Pearson’s coefficients 0.79, P = 0.002 and 0.82, P = 0.001, respectively). These correlations remained significant when a multivariate analysis was performed controlling for age and body mass index (partial correlations 0.76, P = 0.01 and 0.75, P = 0.012, respectively). There were no significant correlations between IGF-1 levels and Barthel Index or the Elderly Mobility Scale scores either at baseline or at 6 weeks.

Fractured side LEP after PFF fixation is a key determinant of walking speed and stair climbing time [4]. We have shown that IGF-1 levels 7–9 weeks after PFF correlate well with LEP. This relationship was not apparent at baseline possibly due to factors, such as post-operative pain, preventing patients generating true maximal LEP on the Nottingham Power Rig. We did not find any statistically significant association of IGF-1 with measures of disability; however the study was small and underpowered in this respect. Administration of human growth hormone has been shown to produce good IGF-1 responses in PFF subjects; however, studies to date have not definitively demonstrated functional outcome improvements to mirror these responses [5, 6]. Our data provide justification for further studies, in elderly patients rehabilitating after PFF, of interventions that raise concentrations of IGF-1.

Figure 1. The relationship between IGF-1 levels and leg extensor power after 6 weeks of rehabilitation.

References

