

# OVERUSE INJURIES OF THE OLECRANON IN YOUNG GYMNASTS

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**We report overuse injuries in 14 elbows of ten élite young gymnasts. In 12 elbows of eight patients aged 11 to 15 years there was a spectrum of radiological abnormalities including widening of the olecranon physis and fragmentation of the epiphysis. The radiographs were compared with those of normal elbows matched for age and sex. The radiograph appearances were very similar to those of the Osgood-Schlatter lesion of the tibial tuberosity.**

**Two older boys, aged 18 and 19, had stress fractures through the olecranon growth plate. Conservative management was successful in all except one case of stress fracture which required internal fixation.**

In gymnasts, the arms become weight-bearing during certain exercises (Goldberg 1980), and about one-third of all their injuries are in the upper limb (Garrick and Requa 1980). Over-use injuries of the elbow have recently been recognised (Priest and Weise 1981; Nocini and Silvij 1982; Szot, Boron and Galaj 1985). Rapidly repeated and maximal extension of the joint is required in gymnastics and this may result in elbow pain (Aronen 1985).

Repeated explosive activity acting on the relatively plastic growing skeleton of young athletes (Maffulli 1989) can influence the limited vascular supply of maturing bones (Jackson, Silvino and Reiman 1989). Repeated minor injury to the epiphyses, growth plates and major tendon attachments may lead to chronic inflammation, the avulsion of areas of cartilage or bone, and microtears and haemorrhages in tendons (Medlar and Lyne 1978). The common sites of involvement are the inferior pole of the patella (Sinding-Larsen-Johansson syndrome: Medlar and Lyne 1978), the tibial tubercle (Osgood-Schlatter

syndrome: Ogden, Hempton and Southwick 1975) and probably the calcaneal apophysis (Sever syndrome: Katz 1981). These lesions are most common in soccer-playing boys and in girl gymnasts (Micheli and Ireland 1987; Kannus, Nittymäki and Järvinen 1988). Excessive traction at tendon insertions or direct pressure may produce symptoms (Katz 1981).

Traction apophysitis at the olecranon is rare; we could find only one case attributed to gymnastic activity (Danielsson, Hedlund and Henricson 1983). The other reported cases were due to diving (Hunter and O'Connor 1980) and hockey (Danielsson et al 1983). Two cases were not related to sport (Danielsson et al 1983).

Stress fracture of the olecranon growth plate is also seen in adolescent patients (Torg and Moyer 1977; Retrum et al 1986), being analogous to the stress fractures of the distal radial physis seen in gymnasts (Carter et al 1988). Acute fractures (Pavlov et al 1981) and stress fractures of the olecranon physis have been reported (Torg and Moyer 1977; Wilkerson and Johns 1990).

We describe changes in the olecranon epiphysis in ten young élite gymnasts.

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## PATIENTS AND METHODS

All the ten patients had had trivial arm injuries during their athletic careers and presented to us with diffuse, dull elbow pain, stiffness, swelling and tenderness over the olecranon with no evidence of any rheumatological condition. The patients were followed for an average of 6.2 years (12 months to 9 years).

The six boys and two girls with traction apophysitis of the olecranon (12 elbows) were all gymnasts of national or international level, and had been training for at least two hours, five times per week for 18 months before



Fig. 1a



Fig. 1b



Fig. 1c

Radiograph of the right elbow of a 13.5-year-old boy with fragmentation of the epiphysis, and a wide translucent gap (a). One year later (b) the superior part is still fragmented. Six months after this, at 15 years of age, and after two months off training (c) there is partial fusion. This athlete also had a chronic stress lesion of the distal radial growth plate.



Fig. 2a



Fig. 2b

In a 13-year-old boy the right elbow (a) shows a ragged epiphysis with a wide, translucent gap. The left elbow (b) shows epiphyseal fragmentation with partially ossified centres in a translucent gap wider than 8 mm.



Fig. 3a



Fig. 3b



Fig. 3c

The left elbow of an 11-year-old boy (a) shows a small epiphysis, an ulnar metaphyseal spur, and a wide gap. Six months later (b), there is a slightly larger epiphysis, but the physis is still wide. At age 16 years (c) there is fragmentation of the ossification centre.

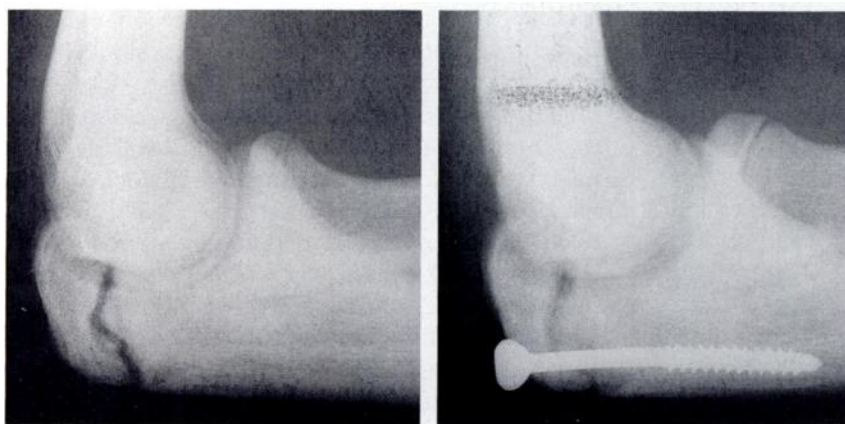


Fig. 4a

Fig. 4b

A 19-year-old male gymnast had pain at the tip of the right elbow for several weeks, with some limitation of extension. There is evidence of a stress fracture through the growth plate (a). Symptoms were relieved by insertion of one screw (b), which became bent.

referral. Their ages at presentation ranged from 11 to 15 years (average 13.5). The girls were older than the boys, averaging 14.7 years as against 13.1 years. Two other male gymnasts aged 18 and 19 years presented with stress fractures through the growth plate of the olecranon, requiring internal fixation in one case. Apart from this case, management was by rest, cryotherapy and physiotherapy.

The 14 abnormal radiographs in these ten patients were compared with 14 randomly selected radiographs of the normal elbows of non-athletic patients matched for sex, side and age within ten months. These were obtained from a review of 225 radiographs taken in an accident and emergency department.

## RESULTS

Details of the lesions are given in Table I. All the 12 elbows showing traction apophysitis healed uneventfully with conservative management (Figs 1 to 3), and all but three were able to return to the same level of competitive gymnastics. These three gave up the sport because of other injuries.

In the two elbows with stress fracture, a band of irregular calcification had developed in a widened growth plate (Fig. 4), and one case needed internal fixation for pain relief.

The 14 control films of asymptomatic children, matched for age and sex, showed an olecranon physis wider than 5 mm in two cases, with some fragmentation of the epiphysis in two other cases.

## DISCUSSION

The olecranon epiphysis appears in boys at between 9 and 11 years of age, and normally closes between 15 and 17 years, though this may be delayed in normal boys up to the age of 19 (Pavlov et al 1981). It is probable that this delay, combined with high intensity training, may have contributed to the stress fracture shown in Figure 4a.

Gymnasts perform highly acrobatic manoeuvres many times in a single training session, so there is risk of an over-use injury to an immature skeleton (Teitz 1982). This risk may be increased by the delay in skeletal maturation shown by elite gymnasts (Malina 1983).

A distinctive feature of the sport is sudden extension of the elbow through the action of the triceps (Aronen 1985). This results in traction and shearing forces on the olecranon, acting at two sites: the insertion of the triceps tendon into the olecranon, and the olecranon physis. Acute avulsion of the olecranon epiphysis has been

**Table I.** Radiographic abnormalities in 14 elbows of ten young elite gymnasts. The other six elbows were normal

Case	Age at referral (yr)	Sex	Side	Radiograph
1	15	F	Right	Translucent gap > 5 mm Ragged appearance
			Left	Translucent gap > 5 mm Ragged appearance
2	12	M	Right	Physis > 5 mm, irregular ossification with several fragments
3	13	M	Right	Translucent gap > 5 mm Ragged appearance (Fig. 2).
			Left	Translucent gap about 1 cm wide, with a ragged appearance Severe fragmentation of the epiphysis, with interposed fragments (Fig. 2)
4	11	M	Right	Ulnar spur, fuzzy appearance, physis > 5 mm
			Left	Disordered ossification, physis > 5 mm (Fig. 3)
5	14	F	Right	Physis > 5 mm, some fragmentation of the epiphysis (Fig. 1)
6	15	M	Right	Fragmentation of epiphysis, ragged and fuzzy appearance
7	14	M	Right	Slightly ragged physis
			Left	Wide physis, fragmented epiphysis
8	13	M	Right	Wide physis, fragmented epiphysis
9	18	M	Right	Stress fracture through physis
10	19	M	Right	Stress fracture through physis (Fig. 4)

described, but traction apophysitis appears to be uncommon, though a few cases have been reported in gymnasts and hockey players.

The fragmentation of the olecranon epiphysis is similar to that seen in Osgood-Schlatter apophysitis of the tibial tubercle. However, the radiographic diagnosis at the olecranon is more difficult, because of its rarity and the occasional presence of multiple ossification centres in a normal epiphysis. By the age of 12 years, the olecranon growth plate is usually narrow, with serpyginous but congruent borders, with an interval between the epiphysis and the metaphysis rarely wider than 5 mm (Silberstein et al 1981).

Stress fractures of the olecranon growth plate are recognised (Torg and Moyer 1977; Retrum et al 1986) and are thought to be fatigue or stress induced fractures of Salter type I (Retrum et al 1986). The growth plate is pulled apart, and transient localised ischaemia prevents cartilage mineralisation. Proliferation of uncalcified cartilage further widens the growth plate (Carter et al 1988). There are enough qualitative and quantitative

differences between the appearances we report and those seen in normal elbows to confirm the diagnosis of chronic stress.

The lesions we describe are probably age-dependent. Even when the olecranon epiphysis is still not fully ossified, traction forces may cause disturbance of blood flow and result in localised areas of avascular necrosis, with disturbed ossification and fragmentation (Turek 1977). This weakens the tip of the olecranon, and predisposes to small avulsion fractures or partial tearing at the enthesis, with secondary calcification (Turek 1977; Medlar and Lyne 1978). When the epiphysis is more mature, but not yet fused, the same forces may produce a stress fracture through the growth plate (Torg and Moyer 1977; Pavlov et al 1981).

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