

## CASE REPORT

# Sequential avulsion of the anterior inferior iliac spine in an adolescent long jumper

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We present here an unusual case of a sequential avulsion fracture of the anterior inferior iliac spine (AIIS), occurring first in the right and then the left AIIS, during long jump attempts. The case of a 17 year old boy with pain around his right groin, which first occurred during a long jump attempt, is presented. Radiographic examination revealed an avulsion fracture of the right AIIS. After conservative treatment, full athletic activity was allowed 2 months after the injury. However, 4 months later the patient returned with a similar pain in the opposite side of his groin. Radiographs revealed another fracture of the left AIIS. The boy underwent the same treatment protocol; he was examined with isokinetic dynamometry. No complication or re-injury occurred during the 2 year follow up period. In the present study, we introduce the first case of a sequential bilateral AIIS avulsion fracture caused by a long jump.

A 17 year old boy came to us with pain around his right groin, which had first occurred during the pre-take off phase of a long jump attempt. Examination revealed an oedema and localised hypersensitivity to the pain in the iliac spine region. Hip flexion and abduction were moderately limited. Radiograms indicated an avulsion fracture of the right anterior inferior iliac spine (AIIS) and showed approximately 1 cm displacement (fig 1). Conservative treatment consisting of bed rest, analgesia, and a five stage progressive rehabilitation program was employed as follows<sup>1</sup>:

- Phase 1: Rest and protection period. Isometric muscle exercises and weight protection are essential (week 1).
- Phase 2: Passive motion period. Patients are allowed to walk with crutches without weight bearing or with partial weight bearing (weeks 2–4).
- Phase 3: Active motion and strengthening period including isokinetic exercises and active joint movements including against gravity (weeks 4–6).
- Phase 4: Resistance exercises to improve muscle strength (weeks 6–9).
- Phase 5: Final period to prepare the athlete for competition. Isokinetic dynamometry may be used to aid decision to allow competition (after week 9).

The patient was able walk without crutches in the 3rd week with minimal discomfort and 6 weeks later bony union was observed without any complications. Full athletic activity was resumed 8 weeks after the injury and competition was allowed in the 4th month.

However, 4 months after the first injury had occurred, the patient returned with a similar pain in the opposite side of his groin after a long jump attempt. Physical examination revealed pain and soreness in the left groin. An approxi-

mately 1 cm displacement of the left AIIS and the healed fracture on the right side were observed on the radiographs (fig 2). The same treatment protocol was applied and bony union was confirmed with x ray and computerised tomography (fig 3).

The patient was examined twice, first at the 6th week (pre-treatment) and then at the 6th month following the last injury, with isokinetic dynamometry (Cybex NORM; Lumex, Ronkonkoma, NY) to evaluate hip flexion and extension, and the peak torques of both extremities. Peak torque of extension at 30°s decreased from 52% to 15% and peak torque at 120°s decreased from 83% to 16%. The Cybex results showed that the patient had nearly regained full muscle strength on both sides (hip extension and flexion) after the rehabilitation period. We considered these results to show complete recovery (table 1).

During the 2 year follow up period no complication or re-injury occurred. Functional and radiological results were satisfactory.

## DISCUSSION

During the eccentric phase of muscle activity, muscle length reaches its maximum followed by sudden and maximal contraction of muscles, which may, in turn, lead to avulsion injuries in the pelvic ring. Although unilateral avulsion fracture of the AIIS in adolescents is an infrequent injury, it occurs most commonly during sports activities.<sup>1–3</sup> Avulsion of the AIIS is less frequent than other pelvic avulsions with an incidence of 14.8–22.1%.<sup>1–3</sup> The rectus femoris muscle seems to be responsible for avulsion of the AIIS. The major function



**Figure 1** Pelvic x ray revealed avulsion and downward separation of the right anterior superior iliac apophysis due to pulling of the rectus femoris muscle.

**Abbreviations:** AIIS, anterior inferior iliac spine



**Figure 2** Pelvic x ray revealed healed right AIIS avulsion but new left AIIS avulsion.



**Figure 3** Pelvic x ray revealed healed bilateral AIIS avulsion 9 months after the first injury.

of this muscle is known to be the extension of the knee and flexion of the hip.

The long jump is a complex action consisting of accelerated running, a stabilised stride pattern, and a single take off to jump a distance.<sup>5</sup> The long jump is known to be the cause of pelvic avulsion because of its complicated nature. During the last phase of the stride pattern and the pre-take off phase, maximal eccentric contraction of the rectus femoris muscle caused the injury in our case. The patient felt a severe groin pain during the pre-take off phase of a long jump during which the front leg was up and the other leg was on the ground in the position of full hip and knee extension and forward spine extension. Avulsions occurred at the ipsilateral side of the leg which was on the ground at the time.

Avulsion fracture of the AIIS is generally treated with bed rest and rehabilitation, which usually leads to a satisfactory

**What is already known on this topic**

Unilateral avulsion fracture of the anterior inferior iliac spine in adolescents is an infrequent injury and occurs most commonly during sporting activities.

**What this study adds**

A sequential bilateral AIIS avulsion fracture caused by a long jump was managed effectively by conservative means.

outcome.<sup>1 5 6</sup> Generally, displacement of the fragment in pelvic avulsions is no more than 1.5 cm, and hence most avulsions can be managed non-operatively.<sup>2 7 8</sup> Returning to daily life and regular sporting activities is the main goal of the treatment. This length of this period is variable, ranging from 3 weeks to 4 months,<sup>7</sup> and is directly related to the formation of a solid bony union and rehabilitation of the patient. Also, the age of the patient, his injury athletic level, and the degree of displacement of the fragment are other contributing factors. Some authors have suggested surgical treatment in conditions of lateral femoral cutaneous nerve entrapment with more than 1.5 cm displacement or severe rotational deformity and a high level of professional involvement in sport.<sup>6 9 10</sup> In our case, after conservative treatment functional and radiological results were satisfactory. Solid bony union of the displaced fragments on both sides was achieved. Isokinetic measurements revealed that final force and muscular endurance were completely restored.

Only two cases of bilateral AIIS avulsion fractures have been reported so far, and both occurred during a 100 m dash event.<sup>7</sup> In the present study, we introduce the first case of a sequential bilateral AIIS avulsion fracture caused by a long jump and managed effectively by conservative means.

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The patient mentioned in this case study gave consent for his details to be published.

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**Table 1** Results of isokinetic dynamometry evaluating flexion and extension peak torque of both hips 1.5 and 6 months after last injury

	30°/s peak torque (Nm)						120°/s peak torque (Nm)					
	Right		Left		Deficit		Right		Left		Deficit	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
CEXT	203	225	97	190	52%	15%	160	185	26	155	83%	16%
CFLE	139	160	67	158	52%	1%	108	161	44	134	60%	17%

CEXT, concentric extension; CFLE, concentric flexion; Nm, Newton meter; Pre, pre-treatment; Post, post-treatment. Pre-treatment indicates 1.5 month results and post-treatment indicates 6 month results.

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