REPAIR OF SPONDYLOLYSIS IN YOUNG FAST BOWLERS

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Fast bowling in the game of cricket requires repetitive spinal extension, lateral deviation, lumbar flexion and thoracodorsal rotation. Back pain is common, and it has been shown that pars interarticularis defects had occurred in over 50% of a group of teenage fast bowlers. Many of these defects will heal, but some cause chronic pain which prevents bowling, although other activities may be painless.

We report the successful results of local screw fusion of the pars interarticularis defects in ten bowlers, and recommend this method for this small group of sportsmen.

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Spondyloysis occurs in about 6% of a normal adult population (Fredrickson et al 1984) but there is an increased incidence in specific groups of sportsmen and women (Ferguson 1974; Jackson, Wiltse and Cirincione 1976; Hardcastle et al 1992). The incidence of pars interarticularis defects in a group of 20 young fast bowlers was 55% (Hardcastle et al 1992), and nine of them had pain induced by bowling. Some of the fractures united without sequelae, but others became chronic, with persisting pain. Fredrickson et al (1984) in a long-term longitudinal study showed that only 3% of cases of spondyloysis obtained union. Pain was not recorded, and there was no mention of any young sportsmen or women, making their patients different from those that we report.

Fusion of the defect in the pars interarticularis attempts to restore normal anatomy and to retain movement at the involved level (Hardcastle 1991). Two techniques have been described: tension-band wiring (Nicol and Scott 1986; Roca et al 1989; Johnson and Thompson 1992) and screw fixation (Buck 1970, 1979).

We now report the results of screw fixation in a specific group of sportsmen. The first operation in our series, in July 1988, was on a first-class fast bowler playing for Western Australia. This was successful, and since then another nine fast bowlers have undergone the operation after the failure of protracted conservative treatment.

PATIENTS

From 1988 to 1991, 23 male fast bowlers were treated for chronic low back pain thought to be due to a pars interarticularis defect. Eight had acute fractures at L4 which healed after conservative management (Fig. 1a). Four of those with chronic stress defects (Fig. 1b) were also managed conservatively by methods which included cortisone injections, and were able to return to fast bowling within three months of the onset of their pain. One player decided to give up the sport.

The other bowlers had at least six months' conservative treatment, which included physiotherapy, avoidance of fast bowling, and local steroid injections to the...
painful pars interarticularis defect. None of these ten was able to return to fast bowling, and all had surgical treatment.

Their mean age was 20.9 years (15 to 25); five had bilateral defects and five had unilateral defects, all on the opposite side to their bowling arm. Only one had minor spondylolisthesis of L5 on S1, with elongation of one pars interarticularis due to a unilateral defect in the absence of a congenital anomaly (Fig. 2). Nine had defects at L5, with one at L4. None showed any other radiological anomaly such as spina bifida occulta or a lumbosacral anomaly. All had standard plain radiographs and transverse and reverse-gantry CT scans at L3, L4 and L5 levels. In only two cases was there evidence of annular bulging of a disc, and none had imaging evidence of nerve-root compression.

The duration of symptoms ranged from 6 months to 8 years (mean 2.2 years), and follow-up was from 6 months to 3 years 11 months (mean 17.9 months). In all cases there were few clinical signs unless the player was examined after he had bowled. Eight patients had low back pain only; two also had infrequent radiation to the leg, never below the knee. On clinical examination pain was experienced only on extension and lateral deviation, and full flexion was possible with no discomfort. None had abnormal neurological signs, or evidence of nerve-root compression.

All the patients were still able to work, including the four who had physical occupations. Their main complaint was the inability to bowl without pain, and none had a medicolegal claim.

THE OPERATION

Through a median longitudinal incision, the involved vertebra is exposed, including the transverse process and facet joint directly cranial to the fracture site. The defects are curetted of all soft and cartilaginous tissue, and all sclerotic bone is removed. Access to the defect is sometimes difficult because it is obscured by the inferior facet of the vertebra above it. In such cases the lower end of the joint capsule is removed where it overlaps the pars interarticularis defect and 1 to 2 mm of the inferior tip of the facet detached by an osteotome, allowing much better exposure of the fracture. The lateral aspect of the superior articular process and the medial third of the transverse process are denuded of cortical bone (Fig. 3).

Below the defect, the lateral aspect of the pars interarticularis and lamina are partially decorticated to the level of the facet without interfering with its capsule, and the cortical bone is removed from the inferior edge of the lamina adjacent to the spinous process. A 3.2 mm drill is used to make a hole from this point through the lamina, directed out to cross the pars interarticularis fracture and enter the pedicle cranial to the fracture. A
Fig. 3a
A reverse-gantry CT scan three weeks after surgery (a) with a diagram to show the bone grafted area (b).

Fig. 4a
Radiographs and diagram to show the alignment of the screws.

Fig. 5a
A reverse-gantry CT scan three months after surgery showing union of the pars interarticularis defects in a unilateral (a) and a bilateral case (b).
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4.5 mm diameter screw, usually 45 mm in length and of either AO cortical or AO malleolar type, is then inserted until it reaches the defect. Cancellous bone graft is taken from the iliac crest and packed into the defect, before the screw is driven across the fracture site into the pedicle (Fig. 4) and tightened as much as possible. More graft is packed on the lateral side from the medial third of the transverse process and the lateral aspect of the superior articular facet to the lateral aspect of the defect and the adjacent lamina (Figs 3 and 4).

Patients are allowed up two to three days after the operation, but activity is limited for the first four to six weeks, apart from isometric exercises, and a lumbosacral corset is worn. Sedentary work, driving, swimming and bicycle riding is allowed four weeks after the operation. The first CT assessment of the union was at eight weeks in unilateral cases and at three months for those with bilateral defects. Once oblique CT scanning showed evidence of union, full unrestricted athletic activity was begun (Fig. 5). Where union was not apparent at three months, a further scan was performed at six months after surgery and in all cases union had occurred at this stage.

Operative findings
Bilateral defects (five patients). In three patients, the bilateral defects were symmetrical, and wide (3 to 5 mm). There was instability to lateral movement in each direction. The other two had a 3 to 5 mm defect on one side and a small defect of less than 1 mm on the other side (Fig. 1b). They had lateral instability only in the direction away from the larger defect.

Unilateral defect (five patients). Four of these defects were at L5 and one at L4, always on the opposite side to the bowling arm. Two patients appeared to have had a stress fracture of the opposite side at some stage but at the time of surgery this was united. All except one had instability to lateral movement away from the side of the defect, and this was abolished by the insertion of the screw.

Complications. Two patients had a superficial wound infection with Staphylococcus epidermidis, which settled in one to three weeks. All screws were correctly placed and there were no donor-site complications, with no local pain or tenderness at the three-month review.

RESULTS

Seven patients had radiological union within three months of surgery (Fig. 5), and the other three had CT evidence of union at six months. Nine of the ten patients have now returned to full unrestricted activity, and the tenth intends to take up fast bowling again at the start of the next season.

Seven bowlers have returned to first-class cricket (six senior and one schoolboy) without restriction and with no pain. One bowler returned and was able to bowl at full pace, but developed a rib-tip syndrome which prevented him from playing cricket for six weeks. At no stage did he have any lumbar symptoms. One bowler developed right-sided hip pain after a left-sided pars interarticularis repair. This hip pain restricted his ability to bowl, but after local physiotherapy he was able to take up fast bowling again at first-class level.

One bowler has continued to bowl at full pace for three seasons and four have completed two seasons. Two others have completed a full season without low back pain. The two, detailed above, had pain from other causes, and one at six months after operation is bowling at practice, but has not yet returned to competitive sport.

DISCUSSION

The cause of spondylolysis is uncertain but it is likely that repetitive movements are important. The pars interarticularis is vulnerable between 14 and 30 years of age since its ossification may not be complete until then (Cyron and Hutton 1978). In sportsmen and women stress fractures of the pars interarticularis tend to occur at a vital stage during their career. Although Fredrickson et al (1984) found that spondylolysis is asymptomatic in many people, our experience is that fast bowlers with these lesions do suffer pain during their specific repetitive movement (Hardcastle 1991; Hardcastle et al 1992). Acute fractures will usually heal (Fig. 1a), and chronic defects may only produce symptoms under increased repetitive loading. Clinical signs are usually minimal, but symptoms often prevent the desired activity.

Surgical repair of the defect by screw fixation was first described by Buck (1970), who reported a 93% success rate in 16 patients and later (1979), an 88% success rate in 75 patients. He gave no information on level or on sporting activity, and accepted up to 3 mm of displacement. Roca et al (1989) had good results in 14 of 15 patients, all with L4 involvement, one also having defects at L3 and one at L5; they also accepted a vertebral slip of up to 3 mm. Nicol and Scott (1986) described a technique which utilised a tension-band wire around the transverse process and lamina of the involved segment. All their seven cases were at L4 level, with two double-level lesions. They achieved good results in all cases except one with 3 mm of forward displacement. Johnson and Thompson (1992) have reported good results in 22 patients using a modification of this wiring technique at L5 level and a bony area for grafting similar to ours (Fig. 3). There were complications of the wiring in three cases, two by rupture and one by pull-out, but good results were seen in some patients despite nonunion of the defects.

Our patients were a selected group who had symptoms only during and soon after fast bowling; it is difficult to compare them with other reported series. Wire fixation is said to be easier than screw fixation, and allows better assessment of union but there have been no biomechanical studies of either technique. We find that screw stabilisation at L5 level is relatively easy, since the pars interarticularis is larger at this level. This is in contrast to pedicle-screw fixation which is more difficult.
at L5 than at more cranial levels. In our ten cases, there was no evidence of malposition, loosening, breakage or backout of screws.

Screw fixation at L5 for pars interarticularis defects requires less soft-tissue dissection than wire fixation. Screw fixation higher in the spine is more difficult, and the transverse process is more accessible. It may be that wire fixation is the method of choice at higher levels and it seems that either technique can achieve good results.

Our results show that surgery will enable a fast bowler to return to full sporting activity, but indications for this are important. None of our patients had pain radiating below the knee, and only one had a very minor spondylolisthesis. All were under 25 years of age; this confirms that good results are achievable in this age group (Johnson and Thompson 1992).

Long-term results are not known, but both Buck (1970, 1979) and Roca et al (1989) reported no late breakdowns in non-sporting patients. Our patient with the longest follow-up (3 years 11 months) continues fast bowling at State level without back pain; he considers that his bowling has improved. All the other players agree that their bowling has improved because of relief from pain.

Conclusions. Spondylolysis is often asymptomatic, but sporting activities which involve repetitive spinal movements may produce enough back pain to stop participation. When conservative treatment fails to produce improvement, surgical repair of the defect may allow a return to full sporting activity. Where there is no evidence of spondylolisthesis or minimal displacement and pain does not radiate below the knee we recommend direct repair of the pars interarticularis fracture.

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REFERENCES


