FRACTURES OF THE LATERAL TIBIAL CONDYLE TREATED BY SKELETAL TRACTION AND EARLY MOBILISATION

A Review of Sixty Cases with Special Reference to the Long-term Results

A. GRAHAM APLEY, PYRFORD, ENGLAND

From St Thomas's Hospital, London, and the Rowley Bristow Orthopaedic Hospital, Pyrford

When the straight knee is subjected to an abduction or valgus strain the medial ligament may tear or the lateral tibial condyle may fracture. This latter injury was first called a "bumper" or "fender" fracture by Cotton and Berg (1929) who considered the injury to be caused by the tyre or fender of an automobile striking the extended leg of the "jay-walking citizen." This mechanism has been accepted by some later authors (Cubbins et al. 1934, Fyshe 1952); but only five of the sixty patients in the present series were injured by a car. More recent work (Wilson and Jacobs 1952, Gylling and Lindholm 1953) has suggested that with the abduction force is combined compression produced by a fall, and this is indeed the more common mechanism. It would seem more logical therefore to call the injury a valgus split or crush, but one is loth to discard an accepted and picturesque term.

A bumper fracture may be defined as a fracture of the lateral tibial condyle caused by a combination of abduction and compression forces. The line of fracture runs downwards from the articular surface producing a simple split, or downwards and laterally separating a large fragment of the lateral condyle; this fragment may be depressed or tilted and occasionally comminuted. The fracture line may continue through the neck of the fibula, and the upper end of the fibula is then displaced with the tibial condyle. The abduction force damages not only the bone but also the medial ligament of the knee.

Bumper fractures have been subdivided in various ways. Gylling and Lindholm (1953) measured the downward shift of the lateral condyle, and Slew (1955), modifying Palmer's (1951) classification, divided the fractures into split fractures with little or no displacement, compression fractures with condylar depression, and T-shaped or Y-shaped fractures. It is difficult to subdivide bumper fractures precisely. I have tried, by estimating the displacement of the lateral condyle, to classify them into three groups: 1) mild, with little or no displacement; 2) moderate, with obvious depression or tilt of the lateral condyle; and 3) severe, with gross displacement or comminution.

TREATMENT BY IMMOBILISATION IN PLASTER

Most authors advocate closed reduction and immobilisation in plaster. The technique of reduction is usually a combined manoeuvre: traction to the leg, adduction at the knee and sometimes lateral compression. With more severely displaced fractures the force of such manipulations may be augmented by using a traction table and compression clamp (Watson-Jones 1955). A few authors advocate operative reduction if displacement is severe (Wilson and Jacobs 1952), sometimes with the addition of internal fixation by a screw (Perey 1952) or by wire or bone grafts (Jakobsen 1953).

Though debate and controversy continue on the disadvantages of open as against closed reduction, there seems to be unanimity on the method of maintaining reduction: namely, by fixation in plaster. The underlying assumptions are, presumably, 1) that osteoarthritis will inevitably follow a fracture into a joint, unless reduction is perfect and is perfectly maintained by rigid immobilisation until union is complete, and 2) that rigid immobilisation is necessary to permit the healing of associated ligamentous damage.
TREATMENT WITHOUT IMMOBILISATION

Most of the patients treated for bumper fractures at St Thomas's Hospital and at the Rowley Bristow Orthopaedic Hospital during recent years have had neither internal fixation nor plaster; instead they were treated by skeletal traction and exercises. Treatment without fixation was described by Perkins in 1940. Furlong (1953) and Fairbank (1954) gave eloquent testimony to the good results obtained without fixation, but, so far as I can discover, no detailed analysis of results has hitherto been published.

The main objects of this paper are to present the results of treatment by traction and exercises, to show that these are satisfactory, and to show that osteoarthritis does not, in fact, follow.

TECHNIQUE OF TREATMENT

The patient is anaesthetised and, if a haemarthrosis is present, the blood is aspirated. A Steinmann's pin is inserted one or two inches below the fracture. With severe displacement an attempt at reduction is made by applying traction through the pin and compression at the knee. The patient is returned to bed with his knee and calf resting on a pillow and with ten pounds' weight traction. The foot of the bed is raised on blocks.

Knee straightening and leg raising exercises are begun on the next day. Within a few days the patient should be able to raise his leg from the bed (Figs. 1 and 2). As soon as this has been achieved knee bending exercises are begun. In the average case the patient should have fully controlled extension, and flexion to at least 90 degrees, by the end of four weeks (Fig. 3).

At the end of six weeks the pin is removed and the patient gets up with crutches. Though he does not take weight on the affected leg, he goes through the normal movements of walking, so that the pattern of neuromuscular control may be more quickly regained.

Crutches are used for a further six weeks, but during the second three weeks of this stage he is able to take increasing weight on the leg. At the end of twelve weeks from injury he
walks unsupported and, unless he has the timidity and fragility of age, without a stick. The patient may return to sedentary work as soon as he gets up, and resume any other job as soon as he feels able.

No reference has been made to radiographs as a guide to treatment; they are probably irrelevant. Radiographs are taken to gratify the patient and for the academic value of confirming how often a good reduction has, by these simple methods, been achieved and maintained (Figs. 4 to 6).

**CLINICAL MATERIAL AND ASSESSMENT OF RESULTS**

The results in sixty patients with bumper fractures are presented. Their average age was fifty-three years. Twelve were treated by immobilisation in plaster (with the addition of screws and grafts in four cases). The remaining forty-eight patients were treated by traction and exercises as described.

The severity of injury was assessed radiologically, and, according to the degree of displacement, cases were classified as mild, moderate and severe. There has been no selection of cases, nor any significant difference in severity between the groups treated with and without fixation in plaster. Thus, of the twelve fractures treated by fixation in plaster, four were mild, five moderate and three severe. Of the forty-eight treated without fixation fifteen were mild, nineteen moderate and fourteen severe. When these figures are compared with those of other authors it seems likely that some cases that I have labelled "mild" would have been classified by others as "moderate." So far as can be ascertained, the cases presented differ from those in previously published reports only as regards the method of treatment.

In assessing the results the following terms were used.

*Excellent*—The knee was normal, did not interfere with the patient’s work or play, did not ache or swell, and had a full painless range of movement.

*Good*—The knee was "barometric," aching in damp weather, or had slight limitation of full flexion, but was otherwise normal and did not interfere with work or play.

*Fair*—The knee hampered the patient slightly, ached after exercise, swelled sometimes and had a little limitation of movement.

*Poor*—The knee was worse than "fair."

The words used here in assessing results are widely used, but they are given different meanings by different authors. I have deliberately restricted "excellent" to those patients whose injured knee was as good as the other knee; if there was even slight restriction of
movement it was classified as "good." No patient whose knee was "excellent" or "good" has had to modify his work or hobbies because of the injury.

The success of any method of treating a fracture involving a joint must be assessed by the long-term results; so in the analysis that follows only the results of those patients examined more than five years after the fracture are considered in detail.

RESULTS OF TREATMENT WITH PLASTER

In the present series—Twelve patients were treated in plaster, only six being available for examination after five years. One result was excellent, two were good, two were fair and one was poor (arthrodesis was necessary).

This number is so small that analysis according to severity would be valueless.

Other published series—In considering the results reported by other authors one must allow for the fact that they may have been based on different criteria. Jakobsen (1953) described the results in sixty-five patients operated upon at the Uneval Hospital: thirty-five were excellent, sixteen good, four fair and ten poor. Perey (1952) described the results in 103 fractures: sixty-one were treated by plaster alone, twelve by operation and screw fixation, and thirty by operative elevation of the depressed condyle and bone pinning. Of these last thirty he was able to re-examine twenty-two after a sufficient interval. Eleven results were excellent or good, eight moderate and three poor. Gylling and Lindholm (1953) described the results in forty-seven cases in which operation was performed on those with severe displacement: six results were excellent, twenty-five good, thirteen satisfactory (this is taken to include patients who varied from "good" to "fair") and three poor. They stated that secondary arthrosis occurred in 55 per cent and was more common in those operated upon.

RESULTS OF TREATMENT WITHOUT PLASTER

Forty-eight patients in the present series were treated by traction and exercises and without any form of fixation. Seven of these were not available for re-examination after one year and they are therefore omitted. In the remaining forty-one patients the results were: excellent twenty-two, good eleven, fair seven, poor one.

Long-term results—Twenty-seven patients were re-examined over five years after the injury (Table I).

<table>
<thead>
<tr>
<th>Duration of Follow-up (Twenty-seven Cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>5–10 years</td>
</tr>
<tr>
<td>10–15 years</td>
</tr>
<tr>
<td>Over 15 years</td>
</tr>
</tbody>
</table>

The late results in these twenty-seven patients treated without fixation were: excellent sixteen, good five, fair five, poor one.

These twenty-seven long-term cases were further analysed according to the severity of the fracture (Table II).

Comparison with other reported series (Table III)—Accurate comparison between the series reported by different authors is not possible. Not only are the fractures subdivided in slightly varying ways according to type and severity, but, more important, the words used to express the results are given different meanings. Classification into "excellent," "good," "fair" and "poor" is a matter for judgment, and judgment is an art rather than an exact science.
LATERAL Tibial Condyle Fractures Treated by Skeletal Traction and Early Mobilisation

DISCUSSION

The treatment of a bumper fracture by traction and exercises, without fixation, is simple and satisfactory. But the all-important question is: does osteoarthritis supervene? Gylling and Lindholm (1953) stated that degenerative changes occurred in 55 per cent of their cases, and there is no doubt that radiographs taken years after a bumper fracture sometimes show persistent depression of the lateral tibial condyle, with irregularity and diminished joint space on the outer side. These radiographic appearances do not, however, correspond in any way with loss of function or with pain. In other words, there may be no clinical evidence of osteoarthritis despite an abnormal radiographic appearance.

For example, a policeman aged thirty-six sustained a bumper fracture in 1942. In 1955 he was doing full duty at Buckingham Palace, with only slight "barometric ache," despite the

<table>
<thead>
<tr>
<th>Severity of fracture</th>
<th>Number of cases</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
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</thead>
<tbody>
<tr>
<td>Mild</td>
<td>8</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Moderate</td>
<td>11</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Severe</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>16</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

TABLE II
Results Five Years or More after Injury

<table>
<thead>
<tr>
<th>Author</th>
<th>Number of cases</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>With fixation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jakobsen</td>
<td>65</td>
<td>35</td>
<td>16</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Perey</td>
<td>22</td>
<td>11</td>
<td>8</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Gylling and Lindholm</td>
<td>47</td>
<td>6</td>
<td>25</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Present series</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Without fixation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present series</td>
<td>41</td>
<td>22</td>
<td>11</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Present series (after 5 years)</td>
<td>27</td>
<td>16</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

TABLE III
Summary of Reported Results

radiographs shown (Figs. 7 to 9). Again, a fireman of forty-six sustained a bumper fracture in 1945. To-day, eleven years later, he is still able to carry a 12-stone man up a ladder, and even to play football. Such examples are not unusual (Figs. 10 to 12). The joint appears to stand up well to hard wear over a period of years. In no case in the present series did the state of the knee alter, except for the better, after the end of one year.

It may be argued that holding the fracture immobilised in plaster might give still better results. The figures quoted do not support this contention. Out of twenty-seven patients treated by traction and exercises and followed up for more than five years, twenty-one gained either excellent or good results, using these terms in their strictest sense; only one result was poor. It may well be that, with a damaged lateral condyle, moulding by movement is the best way to achieve the greatest congruity of the joint surfaces.

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Case 2—Bumper fracture in a woman of sixty-two. Figure 4—Initial radiograph. Traction was applied for six weeks. Figure 5—Eight months later. Figure 6—Seven years later.
The method of traction and exercises permits movement without allowing abduction strain, so that any associated damage to the medial ligament is able to heal. Slight lateral instability does sometimes persist (though not as a disabling or troublesome symptom) whether the knee has been treated on traction or by plaster.

Case 3—Bumper fracture in a policeman aged thirty-six. Figure 7—Initial radiograph. Figure 8—Ten years later.

Case 3—Despite the radiographic changes shown in Figure 8 the patient has a good range of knee movement and is on full duty.

It is doubtful whether plaster can be relied upon to hold a crush type of fracture successfully. In 1937 a woman of forty-eight sustained a bumper fracture; it was reduced, and held first in plaster and then in a caliper for a year. When she was re-examined in 1955 the original
Case 4—Bumper fracture in a man of seventy-seven. Figure 10—Initial radiograph. Figure 11—Five years later.

Fig. 12
Case 4—Appearance of knee and range of movement five years after the fracture.
valgus deformity was found to have recurred (Fig. 13). Prolonged splintage had failed to prevent the crushed bone from collapsing even after a year.

Fortunately any residual deformity after a bumper fracture is valgus, and a valgus knee from whatever cause hardly ever gives rise to clinical osteoarthritis. This is in striking contrast with varus deformity, which so often produces painful stiffness of the knee.

SUMMARY

1. The term “bumper fracture” is colourful but usually inaccurate. The injury is a valgus split or crush.
2. A series of sixty bumper fractures is reported: forty-eight were treated without operation or plaster.
3. Twenty-seven of the forty-eight patients treated without splintage have been followed up for more than five years, and seventeen of these for more than ten years.
4. The results are satisfactory and there is no evidence that there is any late deterioration of the joint.
5. It is suggested that bumper fractures should be treated without operation and without fixation in plaster.

I am glad to express my gratitude to Professor George Perkins, Mr R. J. Furlong and Mr F. A. Simmonds, who treated some of the cases presented, and without whose help and encouragement this paper could not have been produced.

REFERENCES
