LIGATURE OF THE INTERNAL ILIAC ARTERY FOR MASSIVE HAEMORRHAGE COMPPLICATING FRACTURE OF THE PELVIS

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Fracture of the pelvis is a common injury from falls or road traffic accidents. Review of 206 cases admitted to the Bristol Royal Infirmary from 1960 to 1965 showed that most of the fractures were not severe and that disruption of the pelvic ring occurred in only 19 per cent (Table I). There was a mortality rate of 5.8 per cent, but in only one case was death directly caused by the fracture: this patient died during operation from uncontrolled haemorrhage after receiving twenty-one pints of blood (Case 2). Eleven other patients died of causes unrelated to the fractured pelvis (Table II).

<table>
<thead>
<tr>
<th>Types of fracture</th>
<th>Number</th>
<th>Causes</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Road traffic accidents</td>
<td>Falls and indirect injury</td>
</tr>
<tr>
<td>Single bones including unilateral fractures of the pubic rami</td>
<td>132</td>
<td>54</td>
<td>78</td>
</tr>
<tr>
<td>Involving articular surfaces</td>
<td>34</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>Causing disruption of the pelvic ring</td>
<td>40</td>
<td>31</td>
<td>9</td>
</tr>
</tbody>
</table>

TABLE II

CAUSE OF DEATH IN TWELVE CASES OF FRACTURED PELVIS

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia and acute pulmonary oedema</td>
<td>3</td>
</tr>
<tr>
<td>Cerebral lacerations and contusion</td>
<td>4</td>
</tr>
<tr>
<td>Cerebral atrophy (18 months later)</td>
<td>1</td>
</tr>
<tr>
<td>Pulmonary embolus</td>
<td>1</td>
</tr>
<tr>
<td>Multiple injuries</td>
<td>2</td>
</tr>
<tr>
<td>Haemorrhage from pelvic fractures and multiple injuries</td>
<td>1</td>
</tr>
</tbody>
</table>

In addition to the patient who died of haemorrhage two others suffered such massive haemorrhage that seventeen and thirty pints of blood were required to save their lives. In each of these cases the bleeding was eventually controlled by ligature of the internal iliac artery.

CASE REPORTS

Case 1—A man of thirty-six was admitted in July 1960 with a crush injury of the lower abdomen sustained in a chocolate vat. He was shocked and showed signs of peritonitis. Radiographs showed a fracture of the pelvis involving the left ala of the sacrum and both ischial and pubic rami, with considerable displacement of the pelvic ring. There were also signs of an incomplete lesion of the cauda equina. Laparotomy was performed after he had received three pints of
plasma and two pints of blood. This showed nothing abnormal except a large retroperitoneal haematoma. Twenty-four hours later he still showed signs of blood loss and he had required a further twelve pints of blood and plasma to maintain the blood pressure. There was an enlarging haematoma in the left flank.

The abdomen was re-explored and the left internal iliac artery ligated at its origin. The arrest of bleeding was dramatic and no further blood transfusion was required after operation. Eventual recovery was complete with the exception of some urinary and leg disability from the coincident lesion of the cauda equina.

Case 2—A man of twenty-seven was admitted severely shocked after being run over by a lorry. There was marked deformity of the pelvis as a result of a crush fracture with displacement. Immediate laparotomy was performed as the blood pressure could not be raised by rapid blood transfusion.

At operation a large haematoma was found in the sheath of the rectus abdominis muscle and there was about a pint of blood in the peritoneal cavity. The bladder was completely avulsed above the prostate gland and separation of the symphysis pubis was about four inches. During exploration the anaesthetist noted difficulty in inflating the lungs and a radiograph showed traumatic pneumothorax. This was immediately treated by insertion of a tube into the right pleural cavity. On further exploration of the abdomen the main arteries were found intact. The right external iliac vein had been transected, but was not bleeding. Continued haemorrhage came from the retroperitoneal region. While this was being explored the patient developed ventricular fibrillation and normal rhythm could not be restored. He had received twenty-one pints of blood.

Case 3—A boy of sixteen was admitted after being run over by a car. He was severely shocked and there was severe displacement of the pelvis. The left iliac crest had been extruded through the left flank, causing a 15-centimetre (6-inch) laceration. Radiography showed disruption of the pelvic ring and a fracture of the left femur (Fig. 1). There was also a severe head injury and a later radiograph showed fracture of the occiput and diastasis of the sagittal suture.

FIG. 1
Case 3—Radiograph showing severe displacement of the pelvic fragments.
Note also the fractured femur.
At operation there was about a pint of blood in the peritoneal cavity which was coming from a tear in the mesentery. The sigmoid colon was circumferentially torn down to but not through the mucosa. The bleeding points in the mesentery were secured and the colon repaired. There was a massive retroperitoneal haematoma on the left side. He was given five pints of blood during the operation.

After operation his condition remained unsatisfactory and the blood pressure could only be maintained by continuous blood transfusion. In the next eighteen hours he was given a further seventeen pints of blood and developed a large haematoma in the left flank which extended to the midline of the back and to the axilla (Fig. 2). As it was thought that the bleeding was coming from branches of the internal iliac artery, he was operated on again about twenty-four hours after admission and the left iliac artery was ligated.

From the time of ligation of the internal iliac artery there was no further anxiety resulting from continued bleeding, but he remained unconscious and then semi-conscious for ten days in consequence of the head injury. Chest infection required temporary tracheostomy and a large haematoma was evacuated from the flank.

![Fig. 2](case3.jpg)

**Fig. 2**
Case 3—Showing the haematoma extending up into the left axilla and the wound through which the ilium had extruded.

**DISCUSSION**
Fracture of the pelvis with severe displacement may cause death from haemorrhage. In the three patients described in this paper, near fatal haemorrhage was arrested in two by ligature of one internal iliac artery; the third patient died of uncontrolled haemorrhage before the internal iliac artery could be ligated. In the two patients who survived it is presumed that the bleeding took place from branches of the internal iliac artery torn by the displacement. In two cases an initial operation was carried out because of suspicion of intra-abdominal injury, and continued haemorrhage was arrested at a second operation some twenty-four hours later. By this time an additional twelve and seventeen pints of blood had been given and a large haematoma had collected in the flank.

Ligation of the internal iliac artery for arrest of haemorrhage in cases of fractured pelvis has been reported by Seavers, Lynch, Ballard, Jernigan and Johnson (1964) and by Hauser and Perry (1965). In the four cases described by Seavers the bleeding was arrested in three by the operation, but in the fourth, in whom bleeding continued, necropsy showed the presence of atherosclerosis in the iliac arteries. Seavers suggested that this had caused the development of a good collateral circulation rendering ligation of the internal iliac artery ineffectual.

Ligation of the internal iliac artery does not call for any special skill, has no effect on the pelvic viscera, and is not made more difficult by the presence of a large retroperitoneal haematoma. It has been performed as a first step in pelvic operations by many surgeons. Engel and Singmaster (1962) found no case of buttock claudication after bilateral internal iliac artery ligation preceding resection of the rectum, and Given, Gates and Morgan (1964) reported a patient who gave birth to a healthy baby just over a year after ligation of both internal iliac arteries for severe vaginal bleeding.
The absence of complications from reduced blood flow after ligation of one or both internal iliac arteries might suggest that the collateral circulation would render the operation valueless. Our experience and that of Seavers is that ligation of the internal iliac artery can be life saving. Control of haemorrhage is due to the natural arrest of bleeding which takes place during the temporary period of hypotension beyond the ligation.

Ravitch (1964) suggested that retroperitoneal bleeding may be of venous origin and that the collateral circulation would render ligation of the internal iliac artery a valueless procedure. Our belief is that ligation of the internal iliac artery controls haemorrhage. It is highly unlikely that such huge haematomata as we have described could be entirely of venous origin. In one patient (Case 2) death resulted from continued bleeding from the retroperitoneal region while the right external iliac vein was found divided and not bleeding.

As ligation of the internal iliac arteries carries so little immediate or delayed risk it should always be kept in mind in cases of severe haemorrhage complicating fractures of the pelvis.

**SUMMARY**

1. Three cases of severe retroperitoneal haemorrhage complicating fractures of the pelvis are described. In two patients haemorrhage was immediately controlled by ligation of the internal iliac artery. The third patient died before the bleeding could be controlled.

2. Ligature of the internal iliac artery may be a life-saving measure when fracture of the pelvis is complicated by severe haemorrhage.

We should like to express thanks to our orthopaedic colleagues Mr A. L. Eyre-Brook and Mr M. P. McCormack for the help and encouragement they gave in the management of these patients.

**REFERENCES**


