THE NATURAL HISTORY OF THE PATIENT WITH AN INFECTED TOTAL HIP REPLACEMENT

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Deep infection, the most serious local complication of total hip replacement, prompted a study of the records of 135 patients (137 hips) thus afflicted in a nationwide survey of Canada. Particular attention has been paid to the natural history of the infection, and the problems of diagnosis are described. Twenty-one patients died after the insertion, or removal, of the prosthesis, and of the survivors of the original 135 patients only eighteen have been able to retain the prosthesis without further problems with the wound. The remaining patients had the prosthesis removed, and most have dry wounds. Certain suggestions are made on management. The advice that a second total hip prosthesis should be inserted after a deep infection of the first implant is not supported.

Total hip replacement is nowadays accepted as the operation of choice for arthritic conditions of the hip in the elderly patient. Its most serious complication is deep infection, and figures from 0 to 11 per cent have been reported from large series in the recent literature (Table I). The complication is costly and there are many unanswered questions about its management. Charnley (1970) suggested that the infected implant should be removed if it causes sufficient trouble to the patient. Müller (1974) reported that a septic total hip replacement can be preserved in at least two out of three patients with fresh infections. Buchholz (1973) reported a 73 per cent success rate in more than 300 patients by removing the implant in the presence of sepsis and inserting another total hip prosthesis incorporating gentamycin in the bone cement.

A preliminary review of twenty-two patients was reported by Hunter in 1972, but in order to increase the number of patients, a nationwide survey of Canada was carried out, and the records of 135 patients (137 hips) were studied and whenever possible the patient was seen personally by one of the authors.

The diagnosis of deep infection was made by the responsible surgeon, and implied that pus was found around the implant at operation. Patients with superficial wound infections, superficial wound necrosis or haematoma that healed without subsequent involvement of the implant were not included. All of these infections arose in patients who were treated in standard operating rooms (not clean air rooms).

In addition to the patients with definite infections there were a number of patients who still had pain following total hip replacement, the cause of which was undetermined. These patients are not included but their progress is being observed.

The conditions that led to the insertion of a prosthesis are shown in Table II.

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Type of prosthesis—Of the 137 implants, all but six were cemented in position: a cemented metal-on-metal prosthesis was used in fifty-two hips and a metal-on-plastic prosthesis in seventy-nine.

Timing of diagnosis—It is often difficult to make a distinction between early and late infection because of many variable factors. Sixty-eight out of 137 hips (50 per cent) were diagnosed as infected within a month of operation, but it should be noted that thirty-three infections out of 137 (24 per cent) were not diagnosed until a year after the operation. Deep infection was not diagnosed until three years had elapsed in a further four patients. Any reported incidence of deep infection is therefore meaningless unless the patients have been followed for at least four or five years.

Bacteriology—The Concise Oxford Dictionary defines infection as invasion by pathogenic microorganisms. However, in this series, sixteen out of 137 of the initial cultures were sterile, but the surgeon himself diagnosed deep infection from the presence of pus-like material around the implant.

The bacteria reported on the initial cultures are shown in Table III.

<table>
<thead>
<tr>
<th>TABLE III</th>
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<td>BACTERIA REPORTED ON INITIAL CULTURE (137 HIPS)</td>
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<table>
<thead>
<tr>
<th>Gram positive organisms</th>
<th>Gram negative organisms</th>
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</thead>
<tbody>
<tr>
<td>Staphylococcus aureus</td>
<td>E. coli</td>
</tr>
<tr>
<td>Staphylococcus albus</td>
<td>Klebsiella</td>
</tr>
<tr>
<td>Haemolytic streptococcus</td>
<td>Proteus</td>
</tr>
<tr>
<td>Anaerobic streptococcus</td>
<td>Anaerobic bacteroides</td>
</tr>
<tr>
<td>Streptococcus faecalis</td>
<td>Pseudomonas</td>
</tr>
</tbody>
</table>

Sterile cultures | Cultures not available | Mixed organisms |
-----------------|------------------------|-----------------|
16               | 2                      | 1               |

The outlook for a patient with a dislocated prosthesis is poor, for only six of the twenty-three dislocated hips were in a satisfactory position at review, with a healed wound and no pain. Having correlated operative with clinical findings, we do not agree with Patterson (1973), who said that deep infection is always associated with loosening of the prosthesis. Many of the implants reported here were tightly locked in position, and considerable difficulty was often reported in their removal.

No patch tests were carried out for sensitivity to cobalt, chromium or nickel; most patients had had their hip implants removed by the time of review.

METASTATIC INFECTION

Charnley (1972) said that blood-borne infection may occur in roughly 0.3 per cent of cases. He felt that asymptomatic bacteraemia did not cause an infection after operation but he did not deny that there was a possibility of a blood-borne infection occurring in a recent or established implant in the presence of septicaemia.

Since that time, however, Parsons (1971), Mallory (1973), Irvine, Johnson and Amstutz (1974), Artz, Macys, Salvati, Jacobs and Wilson (1975), Benson and Hughes (1975) and Crues, Bickel and Von Kessler (1975) have reported endogenous metastatic infection of a hip implant. In our own series eight of 135 patients suffered from an infection elsewhere in the body (urinary tract, chest or infection of adjacent joint prosthesis) and the same organism was cultured from the wound, suggesting metastatic infection. A further two patients developed infection in both hips with the same organism in each hip joint. This suggests that avoidance of urinary catheterisation and vigorous treatment of chest and urinary infections after operation with the appropriate antibiotic would be advantageous.

INFECTION AND BILATERAL HIP ARTHROPLASTY

Stratton (1974) reported a series of 773 operations performed at Wrightington Hospital, in which 140 were bilateral. Of the latter only five became infected, all on one side only, and on the other side remained free from infection for at least four years.

In our own series, thirty-three patients had had bilateral total hip operations and the opposite hip remained in good condition, free of infection in all but two. In spite of the obvious fear of metastatic infection, these figures suggest that the history of previous sepsis in a single total hip replacement should not deter the surgeon from advising subsequent total hip replacement in the opposite hip if this is necessary.

FATE OF THE DEAD PATIENTS

As expected in a review of this type, twenty-three patients (twenty-four hips) have died since their opera-
tions. Four patients died within three months of either insertion or removal of the prosthesis. In the remaining nineteen patients (twenty hips), seven prostheses were still in situ, but in all except one patient the wound was draining at the time of death.

Thirteen prostheses had been removed before death, and in these cases four wounds were still draining, eight wounds were dry and the outcome was unknown in one.

It should be emphasised that only one patient died with a painless hip implant in the appropriate position with a healed wound.

FATE OF LIVE PATIENTS

Of the 112 patients (113 hips) who were still alive, twenty-eight patients still retained their prosthesis and eighty-four (eighty-five hips) had had the prosthesis removed (Table IV). Only seventeen of the original 135 patients still had the hip prosthesis in position, free of pain and with a dry wound at the time of review. Of the eighty-five hips treated by excision arthroplasty, ten were still draining, and nineteen patients needed further drainage of a recurrent abscess or excision of bone, infected tissue or cement.

<table>
<thead>
<tr>
<th>TABLE IV</th>
<th>Fate of 113 Infected Hips in the Living, in 112 Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retained prosthesis</td>
<td>Hips</td>
</tr>
<tr>
<td>Successful</td>
<td>17</td>
</tr>
<tr>
<td>Failure (severe pain, sinus, persistent dislocation)</td>
<td>9</td>
</tr>
<tr>
<td>Outcome unknown</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
</tr>
<tr>
<td>Excision arthroplasty</td>
<td></td>
</tr>
<tr>
<td>Dry wounds</td>
<td>72</td>
</tr>
<tr>
<td>Draining wounds</td>
<td>10</td>
</tr>
<tr>
<td>Hip disarticulation</td>
<td>1</td>
</tr>
<tr>
<td>Outcome unknown</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>85</td>
</tr>
</tbody>
</table>

We feel that too much emphasis has been placed on bone cement as a cause of a persistent sinus; this is because we find it difficult to believe that the surgeon concerned has been able to remove all the cement from the pelvis and femoral shaft, yet most hip wounds (seventy-two of eighty-five, that is 83 per cent) after excision arthroplasty had healed and remained so afterwards. Further, several patients in this review had obvious radiographic evidence of cement in or around the hip but no problem with the wound. Finally, despite radical removal, in competent hands, of all the cement from a guttered femoral shaft there were still some patients with a discharging wound, which suggested that osteomyelitis was the underlying cause. Dead infected bone is still the commonest cause of a persistent sinus after operation.

Various facts in this review, and a perusal of the literature, suggest certain points in management.

Early diagnosis—Deep infection should be assumed in the presence of pain and a persistent discharge from the wound within the first few weeks after the operation. In this series only eight hips out of sixty-one (13 per cent) were treated successfully after early diagnosis but often inadequate treatment.

Müller (1974) suggested a radical programme. The patient should have the whole of the hip implant exposed and cleaned. All doubtfully viable tissue should be excised, and the wound closed with suction drainage. Indwelling irrigation has given rise to growing concern because of the problem of super-added infection (Wilson 1974).

Appropriate cultures should be taken and adequate doses of intravenous antibiotics should be given. Cloxacillin has been used effectively by Lidgren (1974) but if the patient is sensitive to penicillin, Keftin should be prescribed.

Late diagnosis—When a patient presents with a deep infection several months after the initial operation, or if an earlier attempt has been unsuccessful, then if the patient has severe pain, if the drainage from the hip wound is profuse or the hip is dislocated, the entire prosthesis should be removed, together with as much cement as possible. Subsequent rest to the hip joint may be obtained by skin or skeletal traction for five or six weeks. If, however, the wound is dry and pain is controlled either by analgesics or antibiotics, the hip should not be explored but watched closely.

This review has shown that repeated attempts to retain the prosthesis in the presence of established infection by lesser procedures are useless and destroy the patient’s morale. In this series 135 patients had 490 procedures on the infected hip alone, almost four operations for each hip.

The advisability of inserting a new total hip implant in a previously infected area, which contravenes most standard orthopaedic teaching, has been reported by Patterson and Brown (1972), Buchholz (1973), Fremont-Smith (1974), Müller (1974), Murray (1974) and Wilson et al. (1974).

In this series there were thirty hips in which a total hip implant was purposely inserted into a previously infected area (from an initial failed total hip prosthesis in all but two cases). Cement impregnated with antibiotics (Buchholz and Gartmann 1972) was not used in any of these patients nor did they receive massive antibiotic regimes as suggested by Fremont-Smith (1974). Only ten of the thirty (33 per cent) are so far successful in that the patients are free of pain without problems. The
outcome in one is still uncertain and nineteen hips are recorded as failures. It may be important that of the ten successes, nine showed Gram positive organisms on culture (seven Staphylococcus albus, two Staphylococcus aureus and one culture was sterile). Of the nineteen failures, the organisms shown on culture were as follows: eight Staphylococcus albus, two Staphylococcus aureus, two streptococci, four E. coli and three cultures were sterile.

Buchholz and Gartmann (1972) and Wilson et al. (1974) noted similar problems with eradicating infection in gram negative organisms. This may be related to the fact that the latter, as compared to gram positive organisms, can develop resistance to antibiotics under treatment.

CONCLUSIONS

A review of 135 patients (137 hips) who had infected total hip replacements showed that 50 per cent were diagnosed within one month of operation but 27 per cent were diagnosed one or more years later. The predominant organisms were the Staphylococcus aureus and albus.

The history of pain and wound drainage were the most obvious factors in diagnosis. Apart from dislocation, radiographic abnormalities were not as helpful as has been suggested by some authors. Metastatic infection is a real problem and patients with associated infection after operation should receive vigorous treatment with appropriate antibiotics.

A history of infection of a total hip replacement, however, need not deter the surgeon from doing a total hip replacement for the opposite hip later.

Twenty-three patients had died since the insertion or removal of the prosthesis, but only one had a successful implant and a dry wound. Seventeen patients still living out of the original 135 had retained the prosthesis without further wound infection. The remainder had the implants removed and most had dry wounds. Several needed further operations after the excision arthroplasty but it is suggested that dead bone rather than the cement was the commonest cause of persistent infection.

Delayed diagnosis and poor early management of the infection led to little success in retaining the hip prosthesis. If the patient had severe pain, and drainage from the wound was profuse, excision arthroplasty and removal of as much cement as possible should be done. Repeated lesser procedures in an attempt to retain the prosthesis are to be discouraged.

The results of this survey do not support the idea that a second total hip prosthesis can be inserted after deep infection of the first implant.

It is suggested that each patient about to undergo total hip replacement should be advised of the possible advantages and complications of this procedure. When infection occurs, it needs an average of almost four procedures on the infected hip alone to obtain, at best, a live patient, a pain-free hip, a dry wound, and shortening of the limb with an awkward gait. This state of affairs must make both patient and surgeon extremely guarded about the final result.

Our thanks are due to the surgeons throughout Canada who helped in this survey by allowing their patients with complications to be reviewed. We would particularly like to thank Professor F. P. Dewar and Dr. I. Macnab for their continued support of this project, Dr Garnet Tregonning for reviewing some of the patients and, finally, we would like to thank the Canadian Orthopaedic Foundation for their generous financial help towards the cost of the survey.

REFERENCES


Patterson, F. P. (1973) Personal communication.


VOL. 59–B, No. 3, AUGUST 1977