Complications of Total Hip Arthroplasty and Their Prevention and Management


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Abstract: The complications of total hip arthroplasty are described and treatment is discussed for the following six problems: Postoperative dislocation, femoral fracture, deep infection, heterotopic ossification, aseptic loosening of components, and deep vein thrombosis and/or pulmonary embolism. Postoperative dislocation and deep infection usually occur in the early postoperative period. Good technical skill and careful attention to the prevention of infection are extremely important. The major complications requiring revision are periprosthetic fracture, deep infection, and aseptic loosening of components. In such a situation, the surgeon again needs sufficient technical skill and considerable experience. Ectopic bone formation occurs more frequently in Japanese patients than has been realized previously. Uncemented THA is probably associated with a high rate of ectopic bone formation. Deep vein thrombosis and pulmonary embolism are also increasing because of an increase in western lifestyle. Since pulmonary embolism is often a fatal complication, it should be prevented by adequate knowledge and careful management.

Key words: Total hip arthroplasty; Complication; Dislocation; Infection; Pulmonary embolism

Introduction

The current method of total hip arthroplasty (THA) was first reported in 1961 by Charnley in England.1 During the 38 years that have passed since then, the painful condition of the hip joint, particularly in adult patients, has been treated with excellent functional performance. THA has achieved highly satisfactory results for both patients and surgeons. In Japan, there are about 40,000 hip replacement surgeries each year, combining THA and hemiarthroplasty. THA has a characteristic set of complications, which require careful management and prevention.

The six major complications of THA include 1) postoperative dislocation, 2) fracture, 3) infection, 4) heterotopic ossification, 5) aseptic loosening, and 6) venous thrombosis and/or pulmonary embolism. In this article, these complications are described along with their management and prevention.

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The incidence of dislocation after THA is 1–3%. It often occurs in the presence of soft tissue weakness and happens early after the operation before healing of capsular damage is completed.2,3 Among such dislocations, 70% of the cases occur by one month after THA.

Postoperative dislocation after THA often occurs because of incorrect placement of the prosthetic components, particularly when anteversion of the socket is insufficient, or because the patient is confused or demented. The adequate angle of the socket which should be set is quite limited, i.e., it must be placed at an adduction angle of $40\pm 10$ degrees and at an anteversion of $15\pm 10$ degrees. Deviation from this range can allow the socket to impinge on the femoral head, leading to dislocation when the joint is flexed markedly or is flexed with adduction and internal rotation. Elderly patients often show mental deterioration that makes them incapable of avoiding dislocation by keeping the affected lower extremity in the proper position (Fig. 1).

To prevent dislocation after THA, the surgeon should be sufficiently skilled in placing the prosthetic components properly. In addition, the surgeon must exercise caution because specific problems with the components may occur depending on the approach used and the patient’s position. When the patient is placed in the lateral decubitus position during THA procedure, for example, the socket is prone to tilt backward. To keep it in the proper position, it must be remembered to adequately tilt it forward.

Selection of the correct prosthesis is also important. Implants with a head of 22 mm in diameter, for example, lead to a high risk of dislocation. In elderly patients who have a higher risk of dislocation, a prosthesis with a relatively large head seems to be the best choice. To prevent mental deterioration, it is also important to mobilize the patient from bed as early as possible.

If posterior dislocation occurs, which is the most common type, the affected lower extremity is shortened along with adduction and internal rotation. When such changes are noted, a diagnosis of dislocation must be confirmed by radiography, along with determination of the presence or absence of fracture. Without fracture, the dislocation is reduced manually as soon as possible under general or spinal anesthesia and the joint is immobilized in a spica cast for 3 weeks. If manual reduction is unsuccessful, open reduction will be necessary.

Fracture

Fractures can be classified into two categories depending on the time of occurrence. Those are intraoperative and postoperative fracture. Intraoperative fracture is often associated with the insertion of uncemented component. In this context, it should be noted that the use of uncemented prostheses has been
If the prosthetic stem is loosened, it must be replaced by performing revision arthroplasty. If it is not loosened, open reduction and fixation with a plate are indicated (Fig. 2).

Even experts consider that fractures which occur after THA are difficult to treat and no systematic approach has yet been established. Before treating such fractures, consultation with experts is desirable.

Infection

Infections associated with THA can be classified into two major types, which are early infections occurring within 3 months after THA and late infections occurring from 3 months onwards. Superficial or deep infection occurs in about 1% of patients. The chief caus-
ative organism has been reported Staphylo-
coccus epidermidis, followed by S. aureus.4) Infection has traditionally been the most fear-
ful complication of THA, and its prevention is extremely important.

The lower extremity must be washed before THA to make it as clean as possible, followed by careful antisepsis of the skin, the use of a clean operating room, removal of expired air by the operators wearing special suits like those for astronauts, and prophylactic use of antibiotics after surgery. After THA, blood tests such as measurement of C reactive protein (CRP) and the erythrocyte sedimentation rate should be performed regularly, along with examination of the temperature profile and the wound. When deep infection is suspected because of the persistence of postoperative fever, puncture of the hip must be performed without hesitation and the aspirate must be cultured to facilitate early diagnosis and early treatment.

Late infection can occur up to several years after THA. It may be due to organisms transmitted through the bloodstream from tonsillitis or other sources that colonize the prosthesis in some cases. To prevent late infection, we give patients a leaflet with instructions to be followed after THA. If infection occurs at a site other than the hip, the patient should be treated as soon as possible.

When deep infection has unfortunately developed, treatment becomes very complicated and difficult. Identification of the causative microbial agent is necessary, followed by administration of antibiotics, removal of the infected components, irrigation of the infected site, insertion of bone cement beads impregnated with antibiotics, and finally reinsertion of new components.

Revision arthroplasty can be performed in one or two stages. Various techniques have been proposed, depending on the causative agent and the severity of infection. Because choosing an appropriate therapeutic plan is quite complicated, as described above, consultation with specialists is desirable when infection of prosthetic hip components is diagnosed or suspected.

**Heterotopic Ossification**

The incidence of heterotopic ossification after THA has been reported to be about 20%. Although it has been believed to be higher in Westerners than in Japanese, it seems to be increasing among Japanese patients because of the wider use of uncemented components for THA (Fig. 3).

Severe heterotopic ossification, which restricts the range of motion according to the Brooker classification, seldom occurs. Although the definite cause of heterotopic ossification is unclear, spreading of bone debris throughout the surgical field is considered to be one factor. Therefore, such debris should be removed completely by irrigation of the wound before closure.

Fig. 3 Heterotopic ossification
A 47-year-old woman at 1 year after THA shows Grade 3 heterotopic ossification according to the Brooker classification (arrow). The range of motion is substantially restricted to 40 degrees of flexion, 15 degrees of abduction, 10 degrees of external rotation, and 10 degrees of internal rotation.
When the occurrence of heterotopic ossification is more likely, as in patients who have severe osteoarthritis of the hip associated with marked osteophyte formation, prophylactic administration of indomethacin or other non-steroidal anti-inflammatory drugs and X-ray irradiation can be effective. If heterotopic ossification restricts the range of motion, surgery to remove the bone masses is necessary.

**Aseptic Loosening**

Aseptic loosening is the most serious late complication of THA. It is an event that corresponds to the death of the prosthesis. “Loosening” is generally defined as progressive migration of a prosthetic implant over time, which can be demonstrated by repeated radiographic studies, or as the appearance of a circumferential radiolucent line with a width of 2mm or more that surrounds the cement or a component on an X-ray film (Fig. 2).

There are many factors that are considered to be responsible for the development of aseptic loosening. Typical factors include, 1) the surgical technique, 2) the design, materials, structure, and articulating surfaces of the prosthesis, and 3) patient factors such as the underlying disease, age, sex, weight, and level of activity.

In order to prevent aseptic loosening and prolong the life of the prosthesis, the surgeon should be skilled at performing THA and at choosing the appropriate implant. In addition, the patient should receive postoperative instructions that maintain as good a quality of life as possible. Because THA should be an operation that results in the patient walking well, we usually recommend that patients walk and travel as much as possible instead of instructing them to refrain from various activities.

If aseptic loosening occurs, it should be managed by revision arthroplasty to replace the loosened component. Once a component has become loose, the bone around it is destroyed progressively. Consequently, it is desirable to perform revision arthroplasty before the bone loss becomes excessive. In addition, revision arthroplasty takes longer and causes more bleeding than the primary THA, so it is harder for both the surgeon and the patient. Because the procedure is complicated and more often associated with problems such as fracture, it should be done by orthopedic surgeons who are skilled at performing THA.

**Venous Thrombosis and Pulmonary Embolism**

Venous thrombosis and pulmonary embolism are a current topic of interest. Traditionally, these complications have been considered to be uncommon among Asians, including Japanese. However, the incidence among Japanese patients has been increasing recently, possibly because of Westernization of the diet. Because perioperative death of some Japanese patients due to pulmonary embolism has been reported, these complications are now considered to be important.

In a recent prospective study, venography demonstrated venous thrombi in about 30% of Japanese patients undergoing THA. Older age, female sex, and obesity are pointed out to be risk factors for venous thrombosis.

If deep vein thrombosis develops, it obstructs the venous return and causes the affected extremity to swell. If a thrombus is detached and carried by the blood, it may become trapped in the pulmonary artery. This causes a condition called pulmonary embolism, which is often fatal. Consequently, these two conditions seem to be sequential complications. Both are most likely to develop within 2 or 3 weeks after THA. Pulmonary embolism should be suspected if a patient complains of sudden chest pain and dyspnea after THA. It can be diagnosed by pulmonary angiography or by lung perfusion scintigraphy. Pulmonary embolism must be recognised as a potentially
fatal complication and preparation for its management is necessary. Pulmonary embolism can also be caused by fatty tissue from the medullary cavity that enters the bloodstream during the insertion of a prosthetic component and is carried to the pulmonary artery. When performing cemented THA, the medullary cavity should be debrided and cleaned thoroughly before the injection of cement.

As a preventive measure for pulmonary embolism, anticoagulants are used in Europe and in the United States. In Japanese patients, however, the use of anticoagulants makes it difficult to control bleeding and seems to be unsuitable. We usually use elastic stockings, and an instrument called the AV impulse after THA. This is a device that compresses the veins of the sole intermittently. If venous thrombosis occurs, thrombolytic therapy is given.

As described above, there are a number of important complications of THA. Because so many THA operations are performed these days, the operation should be planned in detail beforehand with the occurrence of these complications being taken into consideration. Care must be taken so that the development of complications can be prevented. After surgery, the temperature profile and the results of blood tests must be examined carefully, with careful maintenance of the operated limb in the proper position, in order to avoid complications such as infection and dislocation.

REFERENCES