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REVIEW ARTICLE

Complex primary total hip arthroplasty

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Summary Although total hip arthroplasty is now a classic procedure that is well controlled by orthopedic surgeons, some cases remain complex. Difficulties may be due to co-morbidities: obesity, skin problems, muscular problems, a history of neurological disease or associated morphological bone deformities. Obese patients must be informed of their specific risks and a surgical approach must be used that obtains maximum exposure. Healing of incisions is not a particular problem, but adhesions must be assessed. Neurological diseases may require tenotomy and the use of implants that limit instability. Specific techniques or implants are necessary to respect hip biomechanics (offset, neck-shaft angle) in case of a large lever arm or coxa vara. In case of arthrodesis, before THA can be performed, the risk of infection must be specifically evaluated if the etiology is infection, and the strength of the gluteal muscles must be determined. Congenital hip dysplasia presents three problems: the position and coverage of the cup, placement of a specific or custom made femoral stem, with an osteotomy if necessary, and finally lowering the femoral head into the cup by freeing the soft tissues or a shortening osteotomy. Acetabular dysplasia should not be underestimated in the presence of significant bone defect (BD), and reconstruction with a bone graft can be proposed. Sequelae from acetabular fractures presents a problem of associated BD. Internal fixation hardware is rarely an obstacle but the surgical approach should take this into account. Treatment of acetabular protrusio should restore a normal center of rotation, and prevent recurrent progressive protrusion. The use of bone grafts and reinforcement rings are indispensible. Femoral deformities may be congenital or secondary to trauma or osteotomy. They must be evaluated to restore hip biomechanics that are as close to normal as possible. Fixation of implants should restore anteversion, length and the lever arm. Most problems that can make THA a difficult procedure may be anticipated with proper understanding of the case and thorough preoperative planning.

Introduction

Total hip arthroplasty is a frequent procedure for orthopedic surgeons specialized in the lower extremities. There are more than 100,000 hip replacements per year and although

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this procedure is well defined in most cases, certain principles must be followed to obtain the expected functional results and for long term implant survival.

Soft tissue trauma must be limited during THA, thus improving neurological and functional recovery while reducing the risk of infection (fewer hematomas, less tissue damage) and neurological complications. Biomechanics of the hip necessary to restore the center of rotation must be respected, including restoring the lever arm and correct positioning of implants to limit impingement and wear from different components, which is a cause of long term implant failure.

Like all surgical procedures, THA also involves managing risks. Thus a difficult THA procedure is a THA that increases functional, infectious, and neurological risks or that involves technical difficulties, and the former may be linked to the latter.

This is why THA requires planning: which surgical approach should be used for the soft tissues? Which implant? How should the implant be positioned in relation to the patient's anatomy? This approach to planning, which was inspired by aviation procedures and which takes the form of a checklist in the operating room, should limit the risk of unforeseen problems during surgery as well as of long- and short-term complications.

Difficulties associated with soft tissue anomalies

This element must be taken into account even if it cannot be seen on imaging.

Limiting soft tissue trauma does not only mean making a small incision, but it also means making it large enough to avoid having to stretch the skin, preserving the muscles and exposing the bones so that replacement components can be correctly positioned.

These requirements mean that a surgical approach that can be extended should be chosen.

Weight

In obese patients the risk of the following complications are significantly increased: postoperative mortality, infection, thromboembolic complications and dislocation [1,2].

THA in these patients is difficult from the outset during the preoperative consultation because the patient must be informed of these increased risks.

Installation of the patient is also difficult and the depth of the soft tissues sometimes requires the use of a specific retractor. However, the surgical approach does not seem to influence the risks even if so called mini-invasive techniques are used [3].

Despite the lower cortical index in obese subjects, the risk of fracture is not higher [4].

On the other hand the procedure will be longer [5] with more bleeding [6] in these patients.

A classic surgical approach is recommended, while paying careful attention to hemostasis. The risk of instability should be evaluated during the preoperative assessment, and specific hardware should be available if necessary, or techniques to stretch out the gluteal muscles to decrease this risk.

Cutaneous complications

There are relatively few problems with the hip if there has been previous surgery: internal fixation, osteotomy... Although ideally an existing surgical approach should be used, the incision can be made elsewhere at no major risk. The surgical approach may also be a problem in irradiated hips, with a risk of healing difficulties. There is also a risk of stiffness due to deep fibrosis. In the presence of extensive skin retraction, plastic surgery may be necessary.

Neurological diseases

Neurological diseases can be separated into two families, those that reduce muscle tone (polio, myelomeningocele...) and those that increase it (spastic hemiplegia, Parkinson's...).

When these diseases have been present since childhood, they result in dysplasia and even dislocation of the hip, due to the increase in stresses that tend to dislocate the femoral head out of the acetabulum.

Whatever the type, a neurological disease increases the risk of dislocation, due to lack of or excess muscle tone. An implant that limits the risk of dislocation is usually indicated.

This justifies a preoperative neurological assessment including an electromyogram (EMG) to ensure that there is a minimum of muscle tone, and possible management of spasticity with appropriate techniques. Spasticity and muscle retraction can be treated by tenotomies during surgery, especially of the adductor muscles [7].

Difficulties due to biomechanical anomalies of the operated hip (significant offset, coxa vara, length of the lower extremities)

The length of the lower extremities and offset are known to be important elements in patient satisfaction [8,9] and implant survival [10], and if these biomechanics are not respected, stresses on contact area are increased [10].

Thus THA must be planned by evaluating length and offset and the components that are best adapted to each case must be chosen. Certain authors suggest using navigation to closely evaluate and restore offset [11].

When traditional hip replacement systems (standard or lateral offset) are not appropriate, a trochanterotomy or special components can be proposed:

- implants with modular stems to restore offset [12], but these are associated with problems of corrosion and breakage due to the modular design and are also more expensive [9];
- hip resurfacing to respect offset and leg length as much as possible [13,14] but this requires significant technical skill: it also involves a metal on metal bearing surface which could pose problems.