Research article

The history of hip replacement and one approach

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Abstract

Hip replacement is a surgical procedure in which the hip joint is replaced by a prosthetic implant. Hip replacement surgery can be performed as a total replacement or a hemi (half) replacement. Such joint replacement orthopaedic surgery is generally conducted to relieve arthritis pain or in some hip fractures. A total hip replacement (total hip arthroplasty) consists of replacing both the acetabulum and the femoral head while hemiarthroplasty generally only replaces the femoral head. Hip replacement is currently the most common orthopaedic operation, though patient satisfaction short- and long-term varies widely. The average cost of a total hip replacement in 2012 was $40,364 in the United States, and about $7,700 to $12,000 in most European countries. We report from the born to modern era of hip replacement’s history.

Introduction

"Tantalus served to the members of his son Pelope. Pelops was resurrected from the outraged gods. A shoulder already eaten by Demeter was replaced with a d'Ivory" articulation (Ovid, Metamorphoses, Book 6, approximately 410-415)

Prosthetic replacement limbs or parts of the joints has always been a key point in the development of orthopedics and its surgical and therapeutic methods. Already with Pare and artistic representations are noted as the ingenuity of physicians and orthopedic sought through means of orthoses and prostheses to correct the defects of the "lame". The hip replacement is the symbol of prosthetic orthopedic surgery.

History Of Hip Replacement

You can died by or with a fall

Folk Popular Said by Moiano (BN)

The trauma and degenerative joint diseases coxofemoral (Coxoarthrosis, osteochondrosis Perthes, sequelae of congenital hip dysplasia, sequelae of the hip joint joint infections) were always of interest on the part of orthopedic as the articulation of hip it is important for the patient's gait. Hip fractures par excellence have always had dramatic developments with the exitus of the patient was happening in the short term with death for thrombus embolism, or suffering for the enforced rest patients. In 1897 Withmann suggested a reductive maneuver applicable both in fractures than in those free fragments wedged. Whitman suggested her that his maneuver had to be performed under general anesthesia, the patient was placed on a table at cards table and was subjected to a tractive force of moderate intensity through the perineal contraction given by the basin support, followed by a great abduction and internal rotation followed by a very accentuta breech pelvis plaster with the limb placed in abduction of 45° to coscia extended. The maneuver Whitmann unfortunately clashes with the vascularity of the femoral head I end terminal that does not allow a consolidation of the femoral head, giving pseudarthrosis or necrosis of the femoral head. From this experience orthopedists looking through osteosynthesis recovered fully of the femoral head, one of the most accurate methods but did not give great results was that dell'ostesintesi with screw telescope Marino Zuco. All 'beginning of the XX century on the other hand there were degenerative hip joint disease. Orthopedic attempted to replace the cartilage or of the articular heads are used many materials: plaster, fir wood, rubber, lead, zinc, copper, gold, silver or fragment of pig's bladder, which does not, however. The first attempts of registered facilities hip replacement durono carried by T Gluck in 1891, in Germany, using the ivory to replace the femoral head.

The first convincing results were obtained in 1923 by Smith-Petersen. The young surgeon in Boston inventor even access front. In the first year after the specialization in surgery he faced a case of fracture of the femur head and replaced it with a glass prosthesis. For a year in the clinical checks he saw that the performance of the prosthesis was favorable but this broke down after a year. Smith realized that prosthetic replacement was ideal in the treatment of femoral head fractures and degeneration of it. He began building glass is endo prosthetic hip arthroplasty. Unfortunately the work of Smith-Petersen was placed on the back burner, as they do not understand it on a large scale was possible to recreate it since the ingegenria of material in those days was not very evolved in biomedical engineering.

At the same time, Hey-Groves (1922) proposes another particularly useful in the fractures of the neck approach. He realized that during trauma the vitality of the femoral head is compromised by cutting the blood vessels that supply blood to the head. It made a replacement of the head in its entirety with an ivory ball of the same caliber. So he described his procedure: "It shall be fixed by a stem which passes through the femoral diaphysis. The prosthesis takes place both at the level of the femoral head and the articular surface of the cup >>. Unfortunately this experimental intervention was an isolated case, although the result was very satisfactory, four years after surgery.

Despite numerous researches the ideal material, solid and well-tolerated by the body, he could not find it. A solution was proposed in 1936 by Dr. Harold Bohlman Venable. After experimenting for many years the interaction between
different metals and the bone, it ended with the superiority of applications alloy Chromium-Cobalt-Molybdenum. Dubbed by the same Venable: Vitalium.

In 1939 Venable filming development Vitalium before metal prosthesis. The Vitalium aimed only to replace the head of the femur with the cartilage that surmounts it, eliminating the phenomenon of avascular necrosis of the head. A Venable obvious question arose: << How to adapt this prosthetic head? >>. Venable at first chose to adjust the metal head through the lateral cortex of the femoral neck with a nail, in an oblique way. After two failed attempts he decided to verticalize the nail.

In 1946 in France the Judet brothers who conceived the first prosthesis in an industrial scale, previously the number was less than 10 managed systems. It all started from the fact that Jean Judet had never liked the joint arthrodesis to relieve severe coxite. He decided it was best to replace the head of the femur to heal coxite that he always carried a serious deficit of movement. Since 1946 the two brothers began to replace the head of the femur with a by a sphere of the same of methyl metacrylate caliber better known by the name of plexiglas. This was fixed on a pin from one side through the neck of the femur. In all cases the results were good in the immediate and medium-term disappointing. These failures were due to 'intolerance of acrylic debris, the Judet method was finally abandoned in 1949.

In 1940 at the Johns Hopkins Hospital, Dr. T. Austin Moore (1899-1963), an American surgeon, has recorded and performed the first hip replacement surgery with Dr. VitaliumVernable. The original prosthesis was modeled on a design that was designed a proximal parts of the femur, with a large fixed head, made of Vitalium. To allow the regrowth of bone tissue and the resulting stability of the prosthesis was applied to a window at the height of the tail of the prosthesis. A hole is placed at the top of the neck to extract, if necessary, the prosthesis. Thus was born the endoprosthesis hip!

A later version of prostheses Dr. Moore, known as Austin Moore, introduced in 1952 is still in use today. Since then almost all the femoral implants resume the concept of intramedullary rod.

At that time, Moore was the psychiatric hospital surgeon of the Columbia State, who had 7,000 beds. Fractures of the femoral neck are common in patients in general old, often in poor condition. In those days, the fracture of the femoral neck was a frequent cause of death in the elderly.

Earlier Moore began to perform work on a basis of Smith-Petersen, because the front. The task is difficult, and poor results: the dislocations are common. Moore thus changed the operative technique. Firstly Moore passed to use a postero-lateral access that led to lower risks for the plant.

However, even with Moore in the case of coxarthrosis or coxite the articular cartilage of the acetabulum, it remained unchanged and dinolte the intervention of Moore did not allow a Preoce patient mobilization.

A Curious Case of prosthetic material of hip endoprosthesis was in ivory with a wide statistic is given by birman doctor San Baw. In 1960 an orthopedic surgeon San Baw, pioneered the use of ivory hip prostheses to replace the fractured femoral necks. The first time Baw used an ivory prosthesis to replace the fractured femoral head of a Buddhist monk 83 years, DawPunya. This work was done when Dr. San Baw was the chief of orthopedic surgery at Mandalay General Hospital in Mandalay, Burma. Dr. San Baw used over 300 ivory hip replacements from 1960 to 1980. He presented a paper entitled "The prosthesis ana Ivory in femoral neck fractures" of the British Orthopaedic Association Conference held in London in September 1969, with a 88% success rate, between the ages of 24 to 87anni and all were able to walk, crouch, cycling and playing football in a couple of weeks after hip arthroplasty surgery. The Ivory may have been used because it was cheaper than metal at that time in Burma and was also thought to have a good biomechanical properties including biological link of ivory with the human tissues nearby. An extract from Dr San Baw paper, which presented to the Conference of the British Orthopaedic Association in 1969, is published in the Journal of Bone and Joint Surgery (British edition), February 1970. With modern hip replacement surgery, you can think to walk postoperative immediately >>.
In the East side of the Atlantic, McKee tried to solve the twin problems that placed the hip osteoarthritis. The wear of the cartilage is bilateral. So McKee proposed the replacement of both the two articual surfaces. The choice fell on the metal. The new head of the femur in the acetabulum was indovata roller covered with a metal shell. Following his example the metal pair against sliding metal between head and acetabulum become the solution for many years by hip designers. Thus was born the artroprotesi!

McKee built a first prototype in 1941, with the first plant, however, is dated 10 years later. The search continued for the remaining 40 years of life. Since its design the McKee plant had as the main problem the bone fixation while the part of the acetabular implant was fixed with the metal shell on its surface till today presents a spiral wire which is inserted into the bone. The femoral component is attached to the diaphyseal cortex of a dish.

McKee planted in 1951 the top three total hip replacements. In two cases the implants were made of stainless steel plant was the third of Vitalium Venable. Mckee noted that the use of Vitalium did not present a tendency so common to "kidnapping." However the problem of bone stabilization was not resolved.

In 1953, McKee met a fellow American, Thompson. Thompson recommend to Mckee, a model that resembled the dentures Moore, but no windows. Thompson convinced Mckee reliability of intramedullary fixation stem femoral prosthesis.

The following model of Inclusive prosthetic implant a femoral head according to Thompson, a bit 'smaller, to be articulated within the metal acetabular prosthesis.

This model was used from 1956 to 1966. In 26 people had been implanted. The results are quite satisfactory in more than 10 years, but in 10 cases out of 26, there was a failure due to 'allentanzione of bone stem. Mckee at the time attributed the poor performance of the plants to repeated rubbing of a metal part. To withstand this stress, seeks to improve the implant fixation system. The real cause of loosening will happen until much later.

Only much later, in 1974, he knew the real reason for loosening of the stem of the plant: the human body reacts to debris released by the stem friction. The macrophages remove foreign particles and attack at the same time, at the same time there is the loss of bone mass and consequently the breakage of bonds of the plants with the bone. It was proposed the cementing of the prosthesis but gave too many frequent contraindications, as periprosthetic fractures, the difficulty of prosthesis regret after the primary one, the migration of the cement into the tissues and irritative reactions. The development of bio-engineering introduced new materials such as hydroxyapatite that enabled the lasting establishment of the stem. With Mckee can be said that modern trotesi hip arthroplasty that was born, the rest of the history of hip replacement is the evolution of the concept of prosthesis McKnee and Moore.

**Access surgical history**

The surgical access is critical for the success of surgery is that of rehabilitation. Commonly the history of hip replacement is technology according to Moore that includes: The skin incision begins dorsally 10 cm from the anterior superior iliac spine, and goes down the side and below the buttocks muscles, to the rear and the top edge of the greater trochanter. After the incision deviates along the diaphysis of the femur to 10-13 cm. Cut the subcutaneous tissue and fascia in the same direction. All this allows a maximum penetration through the buttocks muscles. Broken through to the end where we find the m. gluteus maximus to see the fat and the external rotators of the hip, the m. piriformis, the m. twins, m. obturator and internal m. femoral square. After that we proceed to a cut on the rotator, the greater trochanter, and one medial to n.ischiatico to protect and make the best approach to the hip capsule. At this moment you notice the back of the hip capsule and, through the incision of the capsule, we note the spill coxofemoral joint. Among the advantages is the ease of execution and the least possibility of damage to the greater trochanter and the femoral nerve, but the biggest drawbacks are the rotator injury hip joint. Other disadvantages are bleeding and the difficulty in the perfect patient rehabilitation in the face of a perfect implant of the prosthesis. To overcome these consequences must take a step back and return to primordid she hip replacement, to forget young surgeon in Boston, Smith-Petersen had already identified the most conservative method in hip surgery, which consists in access front which provides: the incision of 6-8 cm length starts a finger lateral to the anterior superior iliac spine (ASIS) and follows the line connecting...
SIAS with the head of the fibula bone the simplest method is to guide to palpate the space between the bands of the m. tensor fascia lata and m. Sartorio. After the skin incision is made the incision of the subcutaneous tissue, and you notice the muscle fascia tensor fascia lata. We make a longitudinal incision of the band and we separate the muscles in this way we opened the space between the beams m. tensor fascia lata and m. Sartorio. Proceed longitudinal incision of the m range. sartorius, but very carefully because there is not no. femoral, n. and cutaneous branches of glutei.Inseriti retractors (Homan hook) between m.tensorfascia and m range. sartorius and approach to 'aponeurosis of m. Femur. It 'very important to identify and bind to. anterior circumflex. Its location is to be in the fat tissue in the distal femoral neck near the m. rectus femoris. After tying the a. anterior circumflex proceed longitudinal incision of the femoral m.retto end and cut the aponeurosis of the m. Femur. The last muscle before the capsule is m. iliopsoas. Using Lambot separates the m. iliopsoas from the front side of the articulation. It is known throughout the capsule. It performs capsulotomy V-shaped, with the electric scalpel. A branch of the V goes from 'acetabulum and the other branch of the V goes from the attack of the capsule of the intertrochanteric line front, and these two branches come together in the distal femoral neck. Lussando the femoral head is making the exchange of the femoral head and 'acetabulum with a prosthetic implant. Although advertising which in 1923 this route of just lately is having access to its prominence in prosthetic surgery. Modern studies have shown that this route of access allows a less bleeding, better post-operative rehabilitation, better coexistence with the prosthesis.

Conclusions

The hip replacement was the mother of today's joint prosthetic. Through the study of materials and surgical techniques for hip replacement they have evolved other joint replacements. Also very often you have to take a step back to understand that methods forget like that of Smith-Petersen, who rightly think of a surgery in respecting the anatomy and physiology of hip joint, can give more benefits than modern methods that depart from the exclusive principle of surgical convenience.

EssentialIconography:

Fig.1: Hungarian 1918 Poster advertising, for orthopedic orthoses for maimed soldiers
Fig. 2: Phases of fracture reduction maneuver according Whitman

Fig. 3: Screw telescope for osteosynthesis of fractures of the femoral neck according Marino Zuco
Fig. 4: First examples of endoprosthesis in Vitallium

Fig. 5: McKee’s Arthroplasty

Fig. 6: Demonstration design hip replacement of both the articular heads joint hip joint.
Fig. 7: XR shows arthroplasty according to McKee

Fig. 8: Stress shielding and loosening
Fig. 9: Evolution of the McKee’s prosthesis, the stem is covered by hydroxyapatite.

Fig. 10: Section axial joint anatomy hip joint. The bold black lines show the common ways of surgical approach for hip surgery.
Fig.11: Line through the Antero Superior Iliac Spine (ASIS) and the lesser trochanter, repere access to the surgical incision anterior according to Smith-Petersen

Essential References:

- U. Del Torto: Lezioni di Clinica Ortopedica . VIII Edizione Piccin Editore 1990:723-739
- Titanium 92-Science and technology, Volume III, 1992, San Diego California
- Titanium technology: present status and future trends, 1985, Dayton OH
- M. Fidanza, Nuovi biomateriali per le protesi d'anca
- Corrosione nei materiali impiantabili ed invecchiamento dell’osso, AntônVoitik . Tratto da L/98 – Rivista Italiana degli Odontoteen