Uncemented total hip arthroplasty

By James Finlay, R.N.

The use of uncemented prostheses in total hip arthroplasty is not a new concept; however there are new developments in the design of these prostheses.

A new type of prostheses with a double layer of vitallium beading on the proximal third, uses biological anchoring through bony ingrowth rather than cement. Research suggest that once the implant has obtained bony ingrowth, the prosthesis/bone bond will be permanent. Loosening will be less likely to occur compared to the cracking of cement and resorption of bone that takes place with cement.

Polymethlmethacrylate (PMMA)

When cement or Polymethlmethacrylate (PMMA) is used, it does not actually bond to the bone, but is separated by a thin layer of blood and tissue debris which becomes scar tissue. This eventually forms a layer around the surface of the cement. As well, when PMMA is mixed, it can reach temperatures close to 100 degrees celsius while setting. This is believed to cause bone death along the edges of the cement and decrease the white blood cell viability. This process may be a contributing factor of increased post operative infections in cemented prosthesis.

The one big disadvantage of uncemented prosthesis is that bony ingrowth takes time and hip implant patients may be non-weight bearing for up to three months. In comparison, the cemented prosthesis patient may be weight bearing the first day post operatively. Therefore your older compromised patients cannot afford the longer post-op recovery times related to possible complications such as pneumonia or decreased joint range of motion.

Medical indications for hip transplant:

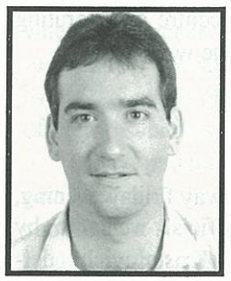
1. Subcapital femoral fractures
2. Avascular necrosis of femoral head
3. Rheumatoid arthritis
4. Revision of prior arthroplasties
5. Osteoarthritis
6. Bony alkylosis

These patients seek medical assistance with complaints of pain, stiffness, motion changes and joint instability. The surgeon's goals in hip arthroplasty are to alleviate pain, create good functional joint motion and increased stability. The surgeon must evaluate the patient before deciding which implant to use.

Large variety

There are a large variety of total hip prostheses available on the market today and there will always be a need for both the cemented and uncemented. In our hospital, we tend to use the uncemented porous coated anatomical (PCA) total hip system in the

About the author



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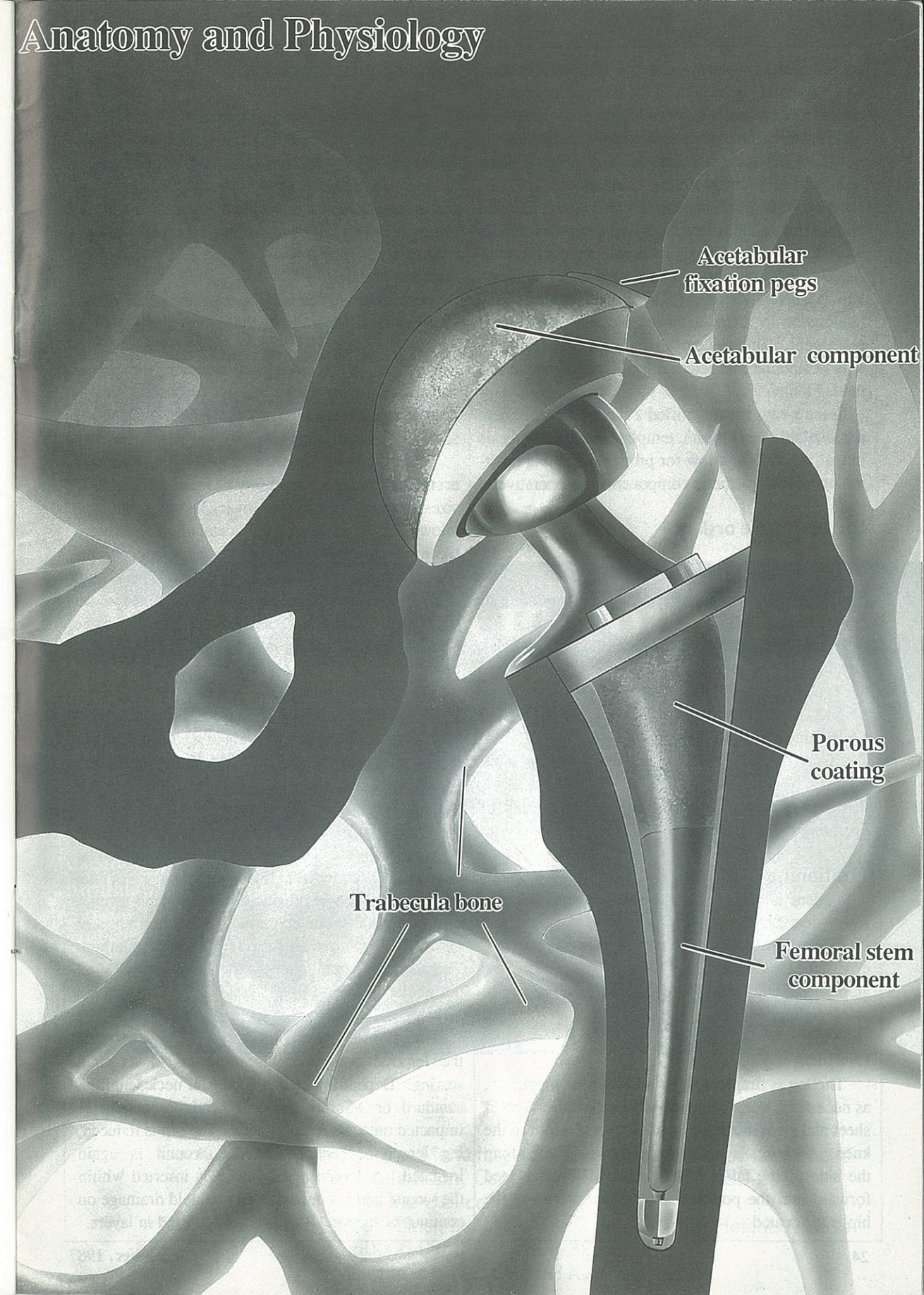

active, healthier patient and the cemented Muller-type Cad total hip system in the older, compromised patient. These and a number of other hip prostheses are available from orthopaedic supply companies.

The PCA total hip system is a multiple sized right and left femoral stem component. It is the same physiological shape as the proximal femur and allows various neck lengths by offering two choices each of the femoral head and acetabular components.

The instrumentation that accompanies this system is specially designed to use anatomical bony landmarks to help achieve accurate component placement. This system also allows trial reduction with acetabular and femoral trial components to test the leg length.

Since x-rays are magnified 17 to 24 percent, there are available clear plastic templates of the prosthesis magnified 20% to allow for proper sizing and positioning of the prosthetic components pre-operatively.

Pre-operative orders

1. NPO after 2400 hours
2. Intravenous 2/3 and 1/3 at 125 cc/hr, morning of planned surgery
3. Complete blood Count, electrolytes, BUN, creatine
4. Type and cross match for 6 units packed cells
5. EKG, chest x-ray
6. Routine urinalysis
7. X-ray of operative hip - anterior/posterior/lateral views
8. Cephapirin sodium 2 grams per IV on call to operating room

Positioning

Patient is placed in a lateral position with the lower leg flexed at the hip and knee, and the operative leg straight. If the patient is placed properly, an imaginary line drawn between the two anterior superior iliac spines should point vertically at the ceiling.

Draping

The leg is draped free to allow for manipulation, as necessary, during the operative procedure. A half sheet and stockinette are applied over the foot to the knee. A pocket is made, using a head drape, along the side of the table. The operative leg is placed forward into the pocket to keep it sterile when the hip is dislocated.

Surgical procedure

An incision is made proximally to the greater trochanter and runs down the lateral axis of the femur distally for approximately 18 cm. Special retractors, which are designed to improve exposure of the acetabulum and femur, are placed. A capsulotomy is done to allow visualization of the acetabulum to allow for proper reaming and good determination of depth.

Anaerobic and aerobic swabs are taken of the synovial fluid. The hip is dislocated, flexed 70 - 80 degrees and the foot is placed in the pocket. Using the femoral neck cutting instruments, the proper measurements are taken and an oscillating saw is used to transect the neck. The head of the femur is salvaged for our bone bank.

The acetabulum is then shaped using hollowed acetabular reamers. A variety of reamers ranging in sizes from 40 mm to 64 mm in 3 mm increments, allows for expansion of the acetabulum to achieve bleeding and meet cancellous bone. Superiorly, the acetabulum has two holes drilled with hollow bone drills to provide acetabular fixation pegs to prevent prosthesis rotation. A trial component the same size as the last reamer is inserted into the acetabulum to check for proper seating and contact with the walls of the acetabulum.

The femur is prepared using the femoral broach which is pounded down the axis of the femoral canal ending with the size of broach that was indicated preoperatively using the x-ray templates. A head/neck trial is then put on the end of the seated femoral broach and a trial reduction is done to check for proper leg length. The trial components can then be removed to allow for final implantation of the prosthesis. The wound site is well irrigated using 1 litre of normal saline containing 20 million units of Penicillin to remove all debris from the acetabulum. The acetabular component is then lined up with the acetabular fixation peg holes and using an introducer, is impacted until it is fully seated. The femoral canal is irrigated and dried with suction and the femoral component is impacted to its final seating. Depending on the final trial neck length, a standard or +5 mm femoral head component is impacted onto the femoral neck. The hip is reduced, leg length rechecked and the wound is again irrigated. A 16 thoracic catheter is inserted within the wound and connected to an airshield drainage on continuous suction. The wound is closed in layers.

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Post-operative orders

1. Sips to clear fluids
2. Intravenous 2/3 & 1/3 at 100 cc/hr
3. Bed rest - Non weight bearing first day post-op
4. Complete blood count, electrolytes
5. Airshield drainage system on continuous suction
6. X-ray of hip - anterior/posterior/lateral views
7. Penicillin 500,000 units IV q6h x 4 doses

Conclusion

Total hip arthroplasties are continually advancing. We now offer the once debilitated patient a return to a productive, pain free, life with a functional hip.

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New era in orthopaedics only a few years away as researchers attempt to refine bone growth protein

In the 18th century, John Hunter, who was titled "the Surgeon-extraordinary to King George III," was the first person to document and teach that the skeleton is a living tissue. Prior to Hunter, bone was thought to be no more alive than stone. Hunter taught that bone steadily remoulds itself throughout life, destroying worn-out cells and replacing them with new bone cells instead of scar tissue.

In the late 50s, Dr. Harold Frost, chairman of the department of orthopaedic surgery at Henry Ford Hospital in Detroit, showed that every bone in the body has a distinctive half-life. For example, half the femur is replaced from the inside out every eight years. Instead of using scar tissue, bone replaces or mends itself with more bone.

The next question was "Why does it do this and what is the biochemical substance responsible for this remoulding or healing ?

Researchers worked diligently on this question, and in 1965, Dr. Marshall Urist of the UCLA School of Medicine predicted that the substance they were looking for would be a pure protein.

Speaking earlier this year at the annual meeting of the American Academy of Orthopaedic Surgeons in San Francisco, Dr. Urist explained that when he was working at UCLA in 1965 he observed bone morphogenetic activity in a crude extract made from demineralized human bone. With the advent of modern protein chemistry, Dr. Urist now thinks that the protein, which he called "bone morphogenic protein (BMP) will soon be commercially available. "The availability of the protein," Dr. Urist said, "will make it possible to repair large bone defects from old infections, injuries, excised tumors, and congenital deformities."

Dr. Urist, who is director of UCLA's bone research laboratory, explains that BMP works as a local hormone, released into the organic matrix of bone "in reaction to the demands of growth and healing of injured parts.

"BMP recruits connective tissue cells around small blood vessels to change their pathway of development from fibrous tissue to bone." He calls the protein {BMP) a "connective tissue cell-recruiting agent for bone replacement."

With BMP, orthopaedic physicians will be able to battle bone defects with a body protein. Presently, the protein is isolated from bone powders purchased from cattle or pig slaughter houses. It requires tons of the powder to yield only ounces of the protein. It would be better to use human protein. But since tons of human bones are not available, this difficulty has to be solved. Enter the genetic engineers.

Using only a tiny amount of the human protein, they are cracking the code in the gene containing the blueprint for the protein. By knowing the code, the geneticists will then locate the gene in a human cell, pull it out and insert the human gene in a microbial cell, which can then be grown in large quantities.

Pharmaceutical and biotechnology firms are currently purifying the protein and planning to scale up production for distribution as soon as it is proven to be effective - within 18 months, says Dr. Urist.

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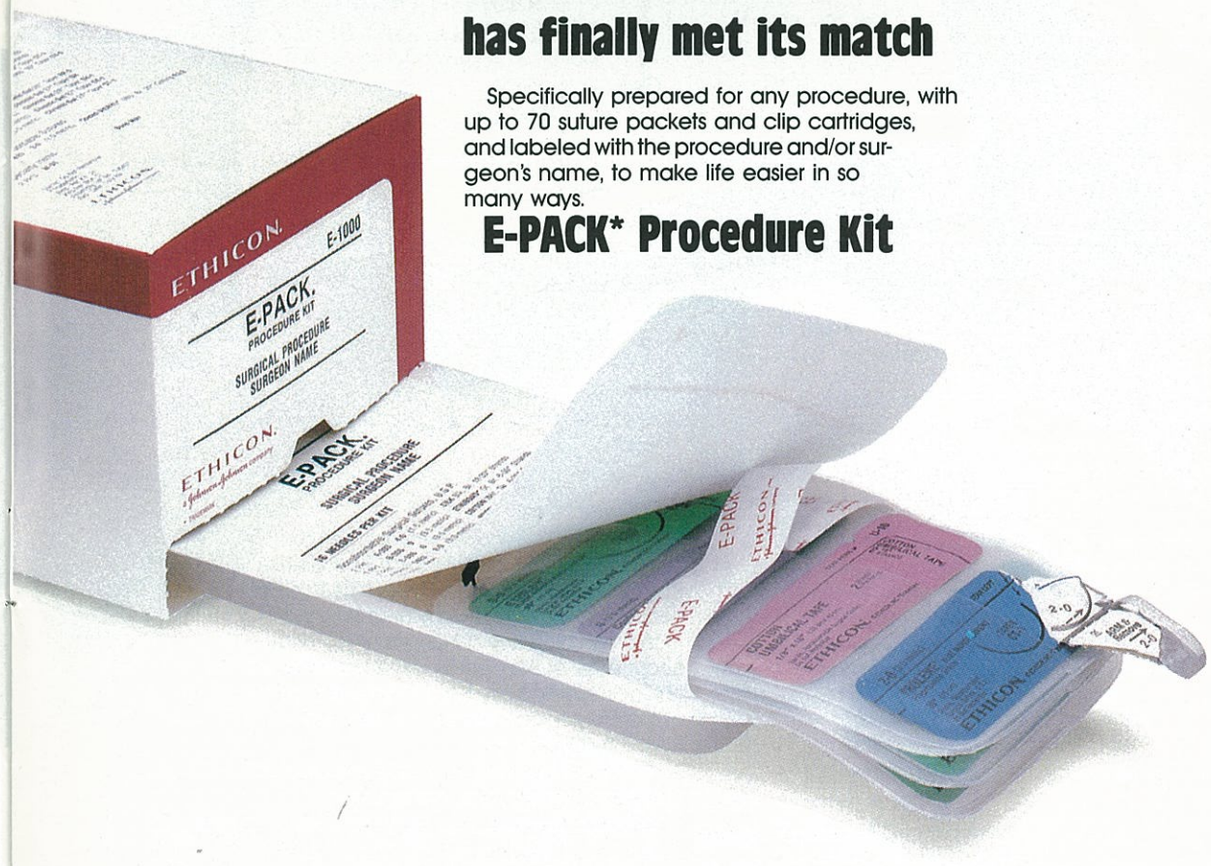

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