I. Introduction

If you are contemplating having a total hip replacement, you should learn the facts, as much as they are known about, the expected benefits as well as the risks and possible complications of the procedure. This information booklet is designed to review the facts of hip replacement surgery as well as the alternative treatments (operative and non-operative) so that you may make a more informed decision regarding surgery.

II. What is Arthritis of the Hip?

The hip joint is a deep ‘ball and socket’ joint that connects the leg to the pelvis. Confusion about the location of this joint is common. In common everyday usage, the term ‘hip’ is applied to a bony ridge in the pelvis which is more accurately termed ‘iliac crest’; (eg., I carried the baby on my ‘hip’).

The hip is actually a joint that is located much lower. It can be found in the location of the groin crease where the leg attaches to the pelvis.

The ball of the hip joint is the ‘femoral head’ which rests within the socket ‘acetabulum’ of the pelvic bone. The surface of both the ball and socket is covered with a 3-4 millimeter thick layer of cartilage. (The cartilage that lines the hip is an exceptional material. It is smoother than any man-made bearing. The cartilage has no nerve endings in it and, therefore, any motion between cartilaginous surfaces does not cause pain. In a patient with arthritis, the cartilage wears away, debris is generated producing pain. As the cartilage wears away, bone becomes exposed. The underlying bone does have nerve endings in it and is not a good bearing material. Motion between bones without cartilaginous surfaces usually causes significant pain.

Normal Hip

Arthritic Hip

III. Types of Arthritis

There are many types of arthritis that may lead to degeneration of the hip joint. The most common form is osteoarthritis. It is not known why some people will have worn out their joints at age 40 while others still have normal cartilage at age 70. Most likely, it is a combination of genetics (the quality of cartilage you were born with) and wear and tear.

Types of Arthritis

- osteoarthritis
- post traumatic (following fracture or dislocation)
- rheumatoid
- other inflammatory (AS, IBD, Psoriatic)
- avascular necrosis, Legg Perthes disease (bone collapse due to loss of blood supply)
- congenital dysplasia (child with hip deformity)
- SCFE (slipped growth plate)

The progression of arthritis from its earliest mild stages to its most severe crippling form is usually gradual. Initially, the pain occurs only after higher levels of activity. Later, it progresses and may become present at rest as well. Physical disability includes limp, muscle spasm, limited walking ability, decreased motion and stiffness, need for a cane, walker or even a wheelchair. The level of symptoms may fluctuate, but, generally, they worsen with time.

During its early stages, usually, arthritis can be treated with medication, supportive devices and modification of activities. However, as the cartilage on both sides of the joint wears away completely and the bone rubs on the bone, the arthritis has become "severe". At this stage, placing a new lining or surface on the joint (total hip replacement) is usually the only effective way to relieve the symptoms adequately.

IV. Non-Operative Treatment

- Activity Modification
- Weight Loss
- Supportive Device
- Exercise
- Heat
- Glucosamine
- Tylenol
- Anti-inflammatory medication, nonsteroidal (NSAIDS)
- Steroids and Anti-Rheumatoid medications

Most commonly, arthritis is a "wear and tear" process; once a joint shows signs of significant degeneration, the more stress it is subjected to, the more it degenerates. Let me use the analogy of a tire on a car. If the tread is thin and worn, it will not last very long driving the car back and forth daily to Atlanta. On the other hand, putting the car up on blocks preserves the tires, but makes the car useless to you. As you can see, the appropriate amount of activity modification is a very individual decision based on common sense. As a general guideline, low stress activities that are usually tolerated well are short distance walking, exercise bicycle, swimming and water aerobics. High stress activities (these are not advised) would include jumping, jogging, long distance walking (> 1 mile) or heavy lifting.

Weight loss will also decrease the stress on a joint. Because of the muscles acting across the hip joint, normal walking causes a force across the hip approximately three to five times the body weight. Therefore, if you are 20 pounds overweight, the force across the hip is increased by 100 pounds. Even small amounts of weight loss will decrease the force about the hip, slow down the destruction of the hip joint and decrease pain. Another way to decrease the force is to use a cane or crutch in the opposite hand. This decreases the required muscle function about the hip during walking and reduces the force on the hip by several hundred pounds.
Exercise is useful mainly to maintain muscle tone and range of motion. Isometric exercises and gentle range of motion exercises should be sufficient. Because arthritis is often a problem of "wear and tear", vigorous exercises and the use of weights only results in further deterioration of the joint.

Heat is also helpful to decrease stiffness and relieve pain. Superficial heat, such as provided by liniments and ointments, etc., do not deliver heat deep enough to be beneficial. The best is a hot water bottle or hot packs because the temperature can be controlled and they deliver a significant amount of heat deep into the joint. Use of a heated whirlpool or spa may also be helpful. Use of a heating pad can be helpful, but care must be taken to avoid burning the skin.

Braces are not effective in the treatment of hip arthritis. Glucosamine, sometimes in combination with Chondroitin, is an over the counter remedy that is proven to be effective for relieving pain. However, it is often advertised as a treatment to rebuild lost cartilage there is no scientific evidence for this claim. It does take 2-3 months of regular use of this material before it gets into your system and relieves arthritis pain. If you notice no improvement in your symptoms after 2-3 months, it is probably not worthwhile to continue using this supplement. The usual recommended dosage is 1500 milligrams per day.

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Tylenol is a very effective and safe pain reliever for the treatment of arthritis. It may be taken in conjunction with anti-inflammatory medications for added benefit. If taken on a regular and prolonged basis, regular check ups and lab tests by your internist are recommended.

The use of non-steroidal anti-inflammatory medications (NSAIDS) is also an important treatment. Aspirin is the most commonly used anti-inflammatory medication, but many people cannot take it because of either allergy or gastrointestinal difficulties. There are many aspirin substitutes that are currently on the market but are significantly more expensive than aspirin. None of them have been shown to work any better than aspirin but they do have less side effects and more convenient dosage frequencies.

Special mention should be made of a new subclass of these medicines called COX 2 inhibitors (Celebrex, Vioxx). These have a more specific action on the joint and less side effects on the stomach and platelets. Usually, they can even be taken by people with ulcers and by those who are on blood thinners, such as Coumadin. Their effectiveness in treating the arthritis symptoms, however, is no different than the other NSAIDS.

More powerful medicine such as steroids, gold (oral or injection) or methotrexate are often used by rheumatology specialists to treat inflammatory arthritis such as rheumatoid arthritis. Chiropractic manipulation may be helpful in alleviating back symptoms that are often confused as hip pain, but there is no role for this in the treatment of hip arthritis. There are many unproven alternative treatments such as magnets, wraps, devices and herbs that may act on the basis of a placebo effect.

V. Benefits of Hip Replacement
When all of the non-operative methods have been considered and are found to be undesirable, hip replacement may be indicated. It must be remembered that hip replacement does not give you a normal joint. It is an artificial joint. It is not as durable and long lasting as a normal joint and it is not as stable as a normal joint.

If a person with a normal joint has a hip replacement, he would not be happy. Similarly, a person with only mild arthritis would not feel a marked improvement with hip replacement. On the other hand, 95% of people with severe arthritis notice a dramatic improvement.

Total hip replacement is one of the most successful of all surgical procedures. A successful result is defined as freedom from pain and restoration of motion as well as function. A successful hip replacement will allow a person to return to the routine activities of daily living. Certain restrictions apply, however. Persons with total hip replacement should not expect to resume jumping or jogging activities. (impact loading). Lifting of weights greater than 30 pounds should be avoided. Multiple repetitive loads, such as walking long distances (greater than a mile) should be avoided. Tennis, horseback riding and racquetball are not advised but golf, swimming and bicycling are good exercises. There are also some restrictions of motion. Although a leg with a hip replacement can sometimes flex up to 120 degrees, it is not advised that you attempt to bend it more than 90 degrees. Therefore, squatting or sitting in very low chairs can be dangerous because of the possibility of dislocation of the hip (coming out of the socket).

Dislocation can also be caused by turning the hip inward or outward to the extremes of motion.

The combination of bending the hip up and rotating it inward is exceptionally dangerous.

An ideal candidate for total hip replacement is a patient who is over 60, relatively sedentary, with normal mental capacity and who is not overweight.

The converse of this represents the so called “high risk patient” for total hip replacement; namely, those who are under 60, overweight, excessively active or who has had a previous total hip that has failed. The relative success rates and risks in this group are discussed below.

In summary, if you are an ideal candidate, the expected benefits from total hip replacement should be a 95% chance of relieving all of your pain and restoring motion and function for routine activities of daily living.

VI. Risks and Complications of Hip Replacement

Early Complications

Infection
Dislocation
Blood Clots
Nerve Injury
Anesthesia
Leg Length Inequality
Heterotopic Bone

Late Complications
Infection
Dislocation
Failure of Bone Ingrowth into Implant
Loosening
Plastic Wear (osteolysis)

All surgeries have risks, so the potential benefits must be carefully weighed. Some complications are related to the surgical procedure and some are related to the delicate balance of the body that is altered during the operation. Potential complications of any surgery include: the risks of anesthesia, bleeding, infection, blood clots, and death.

With modern techniques, the risk of anesthesia related complications is very low.

General and regional (epidural or spinal) anesthesia seem to be equally safe and effective.

Epidural anesthesia has the benefit of allowing optimal pain control for the first 48 hours after surgery. Prior to the surgery, the anesthesiologist will discuss the options with you and help you to decide which type is best for you. Unless you are young and healthy, a complete preoperative medical evaluation by your family doctor or internist would be recommended to identify potential medical problems and, thereby, minimize the risks.

If a blood transfusion is required, there is a potential risk for a transfusion reaction or disease transmission (e.g. hepatitis, AIDS). The risk of contracting AIDS from a blood transfusion is now estimated at one in a million. The risk of contracting hepatitis is approximately one in two thousand. If your hemoglobin is low prior to surgery, it may be beneficial to donate autologous (your own) blood before surgery or receive a series of erythropoetin injections (Procrit) to build up your hemoglobin level. Recent studies have shown that if your preoperative hemoglobin is above 13 grams, you will be unlikely to require transfusion. For patients with a lower hemoglobin, the most effective method to avoid transfusion is a series of erythropoetin injections.

Infection has a very small chance of occurring (1 out of 100 in first time hip replacements and 4 out of 100 for revision hip replacements), but if infection occurs, it is a very difficult problem to treat. Most infections in total hip replacements occur due to contamination at the time of surgery. It is a myth that surgery can be a truly sterile procedure. Any time that people are in an operating room, there will be small numbers of bacteria that can settle in the wound. We take a number

of precautions to decrease the number to a minimum. These include the use of sterile instruments and drapes as well as gowns, masks and head covers. The patient’s leg is thoroughly cleaned with an antiseptic agent and all other areas are covered with sterile drapes. In addition to these routine measures, the surgery is performed in an “ultra clean” room. In this type of operating room a uniform flow of filtered air is continually circulated over the wound. “Space helmets” (body exhaust filtration systems) are also worn by the surgical team. Another measure to decrease infection is the use of prophylactic antibiotics. This means to use antibiotics in advance to prevent an infection rather than to treat it after it occurs. Normally, we use antibiotics during surgery and for 48 hours after surgery.

If infection occurs in a total hip, every effort is made to retain the prosthesis; but this is successful only 20% of the time. If the implant is loose or if the infection continues to recur, it is usually necessary to remove the implant completely in order to cure the infection. This, of course, leaves no hip joint and, although walking is possible, usually two crutches are required. The leg is quite short and weak. At least six weeks of intravenous antibiotics are required to treat the infection. After the infection is cured, consideration can be given to reimplantation of a total hip, but statistics show that 10% of reimplantation cases develop infections again. Therefore, in some cases, the hip is not reimplanted with significant resultant disability.

Another complication that may occur is the formation of blood clots in the legs or pelvis.

Without any preventative measure, the incidence of blood clots in the legs or pelvis is approximately 50% to 60%. In and of themselves, the blood clots are not a great threat; they can be treated with blood thinners and will ultimately resolve. The patient may, however, be left with some permanent swelling of the leg due to destruction of some of the valves in the veins. The big concern, however, is that a portion of the blood clot can break off and go to the lung. This is called a pulmonary embolism; and can be life threatening.

Four different preventative measures can be used to decrease the risk of blood clot formation. The first is the use of a blood thinner (anticoagulant) like Fragmin, Coumadin, aspirin, Heparin. Anticoagulation does seem to be beneficial overall, but may lead to complications of its own (e.g. excessive wound bleeding, need for transfusion or stroke).

The second is the use of spinal or epidural anesthesia (sometimes in conjunction with general anesthesia). Thirdly, mechanical pumps (compressive stockings or boots) can be used. Fourth, early mobilization of the patient is helpful. Finally, several of these may be used in combination resulting in a less than 10% chance of blood clots developing, and less than 1% chance of developing a pulmonary embolus.

Other possible complications need to be mentioned. Dislocations can occur. This is when the ball comes completely out of the socket. A normal hip is held in place by ligaments as well as muscles around the hip. The normal femoral head is quite large and difficult to dislocate. A total hip replacement has a smaller head and all of the ligaments are usually cut at the time of surgery, therefore, it is more unstable. The incidence of dislocation is 2% to 3% in first time hip replacements and 10% to 20% in revision hip replacements. If a total hip dislocates, it can usually be relocated under general anesthesia but without surgery. A cast or brace is then usually worn for six weeks, but approximately one-third of these continue to dislocate and require either a permanent brace or corrective surgery.

Often the leg shortens because the cartilage and bone wears away due to the process of arthritis. When a hip replacement is done, the leg is usually lengthened to tighten up the ligaments and reproduce the normal mechanics of the hip joint. Sometimes the leg needs to be lengthened somewhat more than the opposite side to provide adequate stability and reduce the chance of dislocating the artificial hip joint. This is because the artificial hip joint is never as stable as a normal hip. The pelvis can shift to accommodate small differences in leg length (one-quarter to one-half inch). This may take six months to one year after surgery. Occasionally, a shoe insert or lift is required to raise the other leg.
Heterotopic bone may form in the muscles around a hip joint as a reaction to the surgery. In rare cases, it leads to stiffness in the joint. Cracks or fractures of the bone may occur during insertion of (uncemented) hip implants. Usually, these can be dealt with at the time of surgery with an excellent outcome.

Causes for long term failures include loosening, wear and late infection. Loosening is the process in which the fixation between the bone and the implant breaks down. In a well functioning total hip prosthesis, the motion of the hip only occurs between the ball and the socket. When the implant loosens, motion then occur between the implant and the bone; the implant rubs on the bone resulting in pain. This usually requires "revision"; a repeat operation designed to attach a new implant to your bone.

The risk of loosening in ideal candidates is approximately 5 to 10% in 10-15 years. In non-ideal candidates, such as patients with excessive body weight and younger more active patients, as well as patients who have had a previously failed cemented implant, the chance of loosening is dramatically increased. The other end of the spectrum from the ideal candidate is illustrated by several studies reviewing the success rates of patients under 40 receiving cemented total hips. In these reports, there is a failure rate of approximately 50% within five years due to loosening.

In a cemented implant, loosening is usually caused by cracking of the cement mantle. In uncemented implants, failure of the porous surface attachment to the implant or deterioration of the bone attachment itself can occur.

Wear occurs in the artificial lining surfaces—usually metal or ceramic and plastic (polyethylene). The plastic gradually wears away, much like the rubber on a car tire. The more stress that is placed on the hip, the more it wears. The tiny particles created in this process can result in irritation and destruction of surrounding bone. This is called "osteolysis".

Infection may also occasionally settle in an artificial joint within a matter of months to years after an operation. This may spread from a distant infection of a tooth or the skin. It may cause sudden symptoms or a gradual loosening of the implant.

Revision total hip replacements require special mention. A revision is defined as a total hip replacement done for a previously failed implant. The chances of success in revision hips is only 80% as compared to 90% to 95% for primary procedures. A recent study has shown that this success rate deteriorates for cemented revisions such that only 60% are successful at five years. Most failures are due to loosening. Infection, as noted above, is also more common (approximately a 4% risk).

These complications have been outlined in some detail, not to frighten you intentionally, but to inform you of the possible risks of the procedure. Taken in total, the risks are usually quite low and the chances of success greatly outweigh a chance of failure.

VII. TYPES OF HIP REPLACEMENT

Total hip replacement is an operation designed to replace the damaged joint. Many types of total hip replacements are currently utilized and can be considered in several different categories.

Table; Types of Hip Joint Replacement

Cemented; Type of Fixation
Uncemented—(implant to bone)

Total Hip

Hemiarthroplasty—How Much Bone/Joint Surface replacement—is Replaced

Metal polyethylene

Ceramic polyethylene—Bearing Surface

Ceramic - ceramic

Metal - metal

There are many brands available of each category and there are hundreds of factors (e.g., type of metal, shape of implant, sterilization method, tools for insertion, etc.) that must be considered when choosing the appropriate implant in each case.

Total Hip Replacement-Stem Type with Cement Fixation

In 1962, Sir John Charnley used a small (22mm) stainless steel ball on a stem which was inserted into the bone to replace the femoral (ball) side of the joint and a high density plastic socket to replace the acetabular (socket) side. Both of these components were secured to bone with a self-curing acrylic polymer commonly referred to as bone cement. Several generations of designs have evolved from this original Charnley prosthesis. The ball is now modular thereby allowing balls of different sizes, materials, and neck lengths to be placed onto the stem. Most balls are now made of either a cobalt chrome metal alloy or a ceramic material. Results include consistent pain relief due to immediate fixation and rapid recovery with early weight bearing. It has been the general experience, however, that the long term results of cemented total hip replacements in young, active, and/or heavy patients are not as consistently durable as desired. The loosening rate of cemented acetabular components increases with time leading to many failures after 10 or 15 years. For these reasons, cementless fixation has been advocated by some for younger or more active patients.

Total Hip Replacement - Stem Type without Cement Fixation

We are now in an era with widespread use of devices which are designed to attach to bone without the use of cement. Bone will attach to a metal implant if the surface of the metal has a certain "topography". This process is called porous ingrowth or osseointegration. The bone must be prepared precisely for these devices because close apposition to bone is necessary for bone to grow up to the smooth surface (osteo integration) or into the porous surfaces (porous ingrowth). In general, these devices are larger and longer than those used with cement but are proportional to the size of the individual bone. Surface coatings, such as hydroxyapatite, are also being utilized in an effort to hasten and/or enhance bone fixation.

Many different devices using cementless fixation have been utilized since their introduction in the U.S. in 1977. It is hoped that these devices will maintain their attachment to bone longer, but some caution is advised in their application. Complete pain relief after surgery is not as predictable as with cemented stems. This is related to the type of cementless hip prosthesis and the patient's anatomy, although most improve with time as fixation becomes more rigid. Candidates for these devices are generally younger and more active than those for cemented application.

Total Hip Replacement - Stem Type with Hybrid Fixation

Hybrid fixation is when one component is inserted without cement, usually the socket, and one component is inserted with cement, usually the stem.
BEARING MATERIALS USED IN HIP REPLACEMENT

The most commonly used bearing combinations in joint replacement today are metal or ceramic against ultra high molecular weight polyethylene. These combinations have functioned well for most patients. The durability is less in younger patients because of higher activity levels. The fine particulate debris that is produced causes tissue reaction. This process can undermine fixation and result in loosening. While there is undoubtedly variability in individual tissue reactivity to debris, there is no known methodology to evaluate and determine in advance which patients will react more severely. Since polyethylene wear is proportional to the ball size of the femoral head, it is recommended that the ball size should be reduced to 28 mm (roughly one-half to one-third that of the normal hip) to minimize wear for young and active individuals. However, the use of the small ball can produce instability problems in some individuals who have a greater amount of flexibility in their joints especially if the components are not optimally positioned.

Because of the known deleterious effects of wear debris, research has begun in an effort to minimize the wear of ultra high molecular weight polyethylene. However, it will be many years before we can determine the success of these developments.

Metal-On-Metal Bearings

Metal/Metal (MM) bearings were first used in the U.S. when joint replacement began in the late 1960s. The component design and fixation techniques were primitive by today's standards. Further, the bearing manufacture was inconsistent and these devices were discontinued in the 1970s. Now with modern technology, bearing surfaces can be made optimally smooth and round and thus the wear is minimized. Volumetric wear, compared to polyethylene, can be reduced approximately 100 times. It is also possible that the wear will be reduced even further as research into this aspect intensifies. M/M devices were reintroduced in Europe in 1988. There are now U.S. manufacturers as well as European firms manufacturing all-metal devices.

In addition to reduction in Volumetric wear, the biological tissue reaction locally, based on observation periods of up to 30 years, is less inflammatory, and therefore, less likely to undermine the component's fixation. With metal/metal bearings, unlike metal/polyethylene bearings, there is no penalty for increasing the ball size. Therefore, it is possible to safely improve the stability (by increasing the ball size) to minimize the risk of dislocation.

Ceramic-On-Ceramic Bearings

All alumina-ceramic bearings have been utilized in Europe since the early 1970s. A problem with the early ceramic materials was its large grain structure which led to fractures. Manufacturing of ceramics is now much improved with small grain size creating a much stronger material. These bearings also produce low wear similar to that of metal-on-metal bearings with substantial reductions over plastic bearings. Because of concerns related to the strength of the material, the shells must be made thicker in order to minimize fracture, and therefore, surface replacements are not feasible. The new generation components are much improved for stem-type devices. The all-alumina bearings are another option in the effort to minimize wear and tissue reaction and to provide longer term durability. However, the components must be optimally manufactured to minimize the risk of fracture and inserted precisely to minimize wear.

Hemi-Surface Replacement for Osteonecrosis

One option to minimize wear debris and tissue reaction is to eliminate the bearing by replacing only the diseased part of the joint. A hemi-surface replacement is sometimes recommended for patients who have osteonecrosis of the femoral head (also referred to as avascular necrosis) and have some remaining articular cartilage on the acetabulum or pelvic side. The hemi-surface replacement preserves and maintains bone by providing physiological stress transfer to the femoral neck and proximal femur. It avoids inflammatory reaction and loosening due to polyethylene wear debris.

However, if only one half of the joint is replaced, the degree of pain relief is not as good as for a total joint replacement. Also, if later complete joint replacement is elected, it is more difficult to perform a total surface replacement and
sometimes a stem type implant is required.

Surface Replacement of the Hip

In surface replacement, the femoral neck is preserved rather than amputated as is done in conventional stem-type total hip replacement. The femoral head is reshaped and resurfaced with a prosthetic shell. As a result, the femoral bone is loaded more like a normal hip and the bone is preserved. Since the resurfaced head is very similar in size to the normal hip (about 40-50 mm), it is more stable and dislocation risk is minimal.

There are five potential advantages to these implants that make them worth considering in younger patients. First, less wear and no polyethylene debris generated at the joint surface may lead to a much longer lasting implant that could tolerate more stressful work or recreational activities. Second, less bone is removed at the original procedure, preserving normal anatomy and allowing simpler and more successful revision surgery if needed at a later date. Third, because a large ball size can be used, the stability is much improved over standard total hip replacement which means the patient will have fewer restrictions on their range of motion postop and will have a lower chance of dislocation of the hip. Fourth, thigh pain is not seen (6% in uncemented stem type total hips) because there is no stem that protrudes into the femoral canal. Fifth, there is less blood loss during surgery and therefore, a lower chance of requiring transfusion.

The lessons that we have learned regarding design and technique issues during the past 25 years combined with the modern precision manufacturing of metal/metal bearing surfaces have led to a very much improved device.

One possible undesirable problem with the metal on metal devices is the generation of metallic debris. We believe that the metallic wear debris, based on histological observations to date, appears to be well tolerated in the tissues. However, some people fear that this debris may be toxic to the body. However, at this point, there is no evidence to support this concern. In fact, in a recent study of over 400 patients with metal on metal implants who were observed for 15 years, showed no higher rate of cancer than the general (aged matched) population.

VIII. ALTERNATIVES TO TOTAL HIP REPLACEMENT

Total hip replacement is by far the best solution to most problems involving severe arthritis of the hip. But rarely, in certain circumstances, other alternatives may be more appropriate. In patients who are under 40 who have a problem with only one hip joint and are otherwise healthy, consideration could be given to arthrodesis of the hip. This is when the hip is fused (i.e., the femur bone grows to the pelvis bone) such that no motion occurs at the hip. This completely relieves pain and provides a stable leg for walking. The advantage is that there are no implants that can come loose or fail in the future. It provides a very durable, long-lasting result that does not have the activity restrictions that total hip replacement has. For a manual laborer, it may be ideal because there are no lifting restrictions. The disadvantages are that there is a permanent prominent limp and with time back and knee problems often develop.

In the 40-60 age group or in patients with certain diseases, such as congenital hip dysplasia, an osteotomy of the hip may, occasionally, be the best operative procedure. This is where the upper end of the femur bone near the hip is cut and the hip joint rotated into a new position. This procedure requires that some portion of the hip still have functioning cartilage on it. It is not possible when the cartilage is completely destroyed. This procedure has approximately a 70% success rate and success is defined here as improvement of symptoms rather than complete freedom of pain. It is, however, a conservative operation that preserves the hip joint and can allow future conversion to a total hip replacement.

Another alternative is resection arthroplasty of the hip. This was developed by a man by the name of Girdlestone and is frequently referred to as the &ldquo;Girdlestone Procedure&rdquo;: In this case, a severely arthritic hip is improved by removing the entire ball portion of the upper end of the femur. This essentially removes the hip joint and allows the femur to shorten. Scar tissue develops between the upper end of the femur and the pelvis bone and allows motion with minimal
pain. The leg, however, is quite short and weak and usually patients require at least a cane and often two crutches to walk. Again, the older the patient, the more difficult it is to walk with a resection arthroplasty. This procedure is usually reserved as a salvage for failed hip replacements that for some reason cannot be revised. In this instance, when the hip replacement is removed, you are essentially left with a "Girdlestone". Again, the success rate of this procedure is in the 70% range and success again does not imply total relief of pain, but rather an improvement as compared to the situation before the operation.

Patients that have avascular necrosis may be a candidate for a vascular bone grafting procedure to restore blood circulation to the femoral head and thereby, allow the bone to heal and avoid collapse of the femoral head.

In your particular case, one of these alternatives may be applicable. This should be discussed with your orthopaedic surgeon.

In my opinion, there is no longer any role for partial hip replacement (Hemiarthroplasty) in the treatment of hip arthritis. The only role for partial replacement is in the treatment of elderly patients with broken hips.

IX. SPECIAL STUDIES

To assist us in selecting the most appropriate method of treatment, additional studies may be required on an outpatient basis. For the studies noted below, our office will gladly assist you with scheduling.

Aspiration & Arthrogram

Aspiration is desirable to obtain information about the presence or absence of infection, particularly if you have had previous surgery. The radiologist may be able to aspirate fluid directly from the hip joint, which will provide valuable information. Final culture results are usually available in 7 - 10 days. In general, these procedures are not very painful; local anesthesia is utilized in the skin. On occasion, mild discomfort may be associated with the study. Most often it is transitory and usually can be relieved by medications. These tests have been most helpful in ruling out or establishing the presence of infection, and in some cases, outlining the areas of loosening.

Radionuclide Scans

If there is a concern about infection, you may be scheduled for an Indium-111 Radioisotope Scan. This requires removing some of your own blood and labelling it with an isotopic material (Indium-111) which is then re-injected. You will return one day later and the area of the joint will be scanned. This procedure is sometimes used in combination with other more routine types of scanning agents so as to evaluate patients with infection or sepsis.

All of the isotopic agents are relatively innocuous. The amount of radiation is generally not much more than a single x-ray exposure. Complications have been minimal. Computerized scanning is sometimes combined with injection of these agents to better define the changes in a three-dimensional way.

MRI

Magnetic Resonance Imaging is a special study that uses a large magnetic field and radio waves to obtain images of the inside of the body. This technique may be useful in evaluating the soft tissues around the hip or detecting the early stages of osteonecrosis. It cannot be used to evaluate the hip, if you already have a hip replacement.
CAT SCAN

CAT scan (computerized axial tomography) is a specialized x-ray scan that can provide additional information about the anatomy of the pelvis or thigh bones and the amount of bone stock available. It is frequently necessary in such conditions as congenital dysplasia, Legg-Perthes disease or osteonecrosis, or if a custom-type prosthesis may be needed.

BONE DENSITOMETRY

Your bone changes in quality and quantity with increasing age (osteoporosis) and also in response to an implant. Bone densitometry is a new technique which can more accurately quantitate these changes.

X. Planning for Your Surgery

Medications

If you are taking anti-inflammatory medications such as aspirin, Indocin, Motrin, Feldene, Naprosyn, Voltaren, Mobic, Lodine, etc., it is advised that you discontinue their use one week prior to surgery. Please stop Coumadin 6 days prior to surgery. Rheumatoid medications such as Methatrexate and Embrel should be stopped one month prior to surgery and held one month following surgery. Plavix and Aggrenox should be stopped 14 days prior to surgery. It is also recommended to discontinue all herbal supplements or other over-the-counter remedies two weeks prior to surgery. You may continue to take Celebrex and Tylenol until the day of surgery.

Home Exercises

Obtaining crutches or a walker and practicing walking with these before your surgery is very helpful. It is also recommended that you begin a preoperative program of exercise (only if it is comfortable to do so). Easy isometrics (muscle tensing exercises) will help maintain the strength of your leg muscles in preparation for postoperative walking. The following exercises can be done in bed. Exercise each leg remembering to breathe normally throughout the exercise. Perform 2-3 times per day.

- Gluteal Setting Exercise: Squeeze your buttocks together tightly, hold for ten counts. Relax. Repeat 10 times.
- Quadriceps Setting Exercise: Tighten the muscle on the top of your thigh by pushing the back of your knee down on the bed. Hold for 10 counts. Relax. Repeat 10 times.
- Hamstring Setting Exercises: Keep the knee bent slightly. Push your heel down into the bed and then pull toward buttocks. Hold for 10 counts. Relax. Repeat 10 times.
- Ankle Circles: With lower leg resting on a towel roll, move the ankle in a circle first in one direction, then in the other. Repeat 10 times.
- Ankle Pumps: Move the ankle up and down slowly. Repeat 10 times.

You will be using your arms often during the postoperative period while moving in bed and with the walker or crutches. Therefore, strengthening your upper body is also important. Exercises should include:
- Pull-ups: While sitting in a chair, hold onto a bar that is overhead and raise your buttocks off the chair. Repeat 10 times.

- Reverse Push-ups: While sitting in a chair, place your arms at your side and hold onto the chair next to your buttocks. By straightening your elbows, lift your buttocks off the chair. Repeat 10 times.

- You can also do general strengthening exercises with small weights.

**Weight Reduction**

The stresses across the hip joint are high and can be equal to three times your body weight during normal walking. Therefore, one pound of weight reduction equals three pounds in stress reduction. These reduced stresses can be helpful both before and after your surgery.

**Home Preparation**

After your surgery you will be using either a walker or crutches. You should try these around the house and make sure important areas (bathroom, kitchen, and bedroom) are easily accessible. You may need to rearrange furniture or temporarily change rooms for your convenience after your surgery. Remove all throw or area rugs that could cause one to slip. Bathroom modifications which may be helpful include a shower chair, gripping bars, flexible shower handle, non-slip floor surfaces or mats, soap bars with a string attached and a long-handled scrub brush. If you live alone, you may want to make arrangements to have a friend or relative stay with you for a short while after your surgery. This is especially useful in meal preparation, carrying various items such as plates and cups, and putting on socks. It may be helpful to wear shirts with pockets and/or to drape a small canvas or plastic bag over your shoulder for carrying smaller items. Occasionally, patients are sent to a rehabilitation facility after their surgery until they are stronger.

**Medical Evaluation**

Hip replacement surgery is a major procedure and care must be taken that you are in the best medical condition. You must see your regular medical physician within a month of your surgery. He or she will perform the necessary tests. Please arrange to have the this physician send to our office, prior to your pre-operative orthopaedic appointment, all test results as well as a note which clearly states that you may undergo the proposed surgery, fax # 803-933-6754. Your surgery will be postponed if our office does not receive the test results and/or surgical clearance in time. If you do not have a regular medical physician, we can provide a referral. You need to be seen in our clinic within seven days of your surgery. At this time we will review the proposed surgery with you and answer any last minute questions you may have. It is imperative that you not eat or drink anything after midnight (12:00 AM) the night before surgery. This helps to prevent potential nausea and vomiting from occurring during surgery which could cause complications.

**What to Bring to Hospital**

The Physical and Occupational Therapy Department will provide a walker or crutches, raised toilet seat, and reacher and other equipment needed. If you already have this equipment, please bring it with you. To enhance your postoperative therapy, a knee-length robe or gown is recommended. (Do not bring floor-length robes as they make walking difficult.) Ladies may want to bring a camisole or lightweight cotton shirt to wear under the hospital gown for added warmth. Leave all jewelry at home! A package containing personal care items is provided. Loose fitting pajamas or sweats are useful to wear on the way home. Bring comfortable, sturdy bedroom slippers with non-skid soles and a comfortable pair of shoes to wear for the trip home. Of course, good reading material may help pass the time more quickly.

**XI. THE OPERATION**

On the day of surgery you will first be taken to the pre-anesthesia room where the anesthesiologist will discuss your anesthesia options. Two types of anesthesia are commonly used for hip surgery. The first is a general anesthesia which
puts you in a deep sleep and therefore requires assistance with your breathing. The second type of anesthesia (spinal anesthesia) works by numbing your legs so you do not feel the operation. This is done by placing numbing medicine in the spinal canal in your lower back. You are also given medicine to relax you so you will fall asleep, but you can still breathe on your own. The potential advantages of the spinal anesthesia include less blood loss and less risk of lung problems and blood clots in the legs. A long acting narcotic is used in combination with the numbing medicine to help you get longer pain control post operatively.

You will then be taken to the operating room and devices will be placed on you to monitor your heart, blood pressure, breathing, and temperature. The anesthesia will be administered, you will be placed on your side with the operative side up, and a slightly curved incision will be made over your hip and thigh. I now perform most total hip and hip resurfacing procedures using minimally invasive techniques requiring usually a 3 to 4 inch incision.

At the end of the surgical procedure, the incision is then closed with subcuticular sutures, steri-strips placed over incision, and a compression dressing is applied.

XII. POSTOPERATIVE RECOVERY

Immediately following surgery, you will be taken to the recovery room where you will stay 1 to 2 hours. Your blood pressure, circulation, respiration, temperature, and wound drainage are carefully monitored. Patients may be transferred to an intensive care unit (ICU) for a day or two if close monitoring is needed. Most patients will be transferred directly to their own room. Private duty nurses are generally unnecessary.

Through an intravenous (I.V.) tube which was placed in your arm vein during surgery, you will be given antibiotics and fluids. The I.V. will be disconnected on the first post op day, if antibiotics are still needed, they can be given to you orally for a few more days. Because you will probably feel some discomfort after surgery, pain medication will be given to you every three or four hours as needed or you will have a special machine called P.C.A. in which you may self-medicate. A tube (Foley catheter) is inserted into your bladder during surgery to keep it empty and this is removed on the first post op day.

Several measures are used to help prevent the formation of blood clots in your legs which can become dangerous. Mechanical leg or foot pumps are placed on your legs during surgery and will remain on day and night until you get your blood thinner and become ambulatory. These help in preventing blood pooling in your legs while your leg muscles are not performing this function. You will be encouraged to do bed exercises (isometrics and ankle circles) which the nurses and physical therapist will teach you. Blood thinning drugs (Lovenox, Arixtra, and Fragmin or Coumadin) are given and blood is drawn to determine the appropriate dosage with Coumadin only. For our out of state patients, the medical social worker at Lexington Medical Center will mail your prescription of the blood thinner. This must be filled in your hometown and brought with you to South Carolina. This will be used once you go home from the hospital.

In order to prevent respiratory complications you will be asked to breathe into "blow bottles" and cough several times a day.

The wound dressing is usually changed on the second day after surgery, or as indicated by the physician. Usually, all the stitches are buried under the skin (subcuticular closure) and dissolved after several months. Usually, there is no need for suture or staple removal.

Each day you should feel a little more comfortable as your hip heals and becomes stronger.
On the first day following surgery the physical therapist will get you out of bed to a chair and later you will begin to walk short distances in the morning. All lines and catheters are removed. The afternoon therapy session will involve a longer walk in the hall. You will also be taught your hip exercise program by the therapist. You may be ready for discharge at the end of the first postoperative day. If you should have too much pain or difficulty ambulating, you may need to stay until the second post op day.

There are a few activities we will ask you to avoid during the first 6 months after surgery. These include jogging and impact sports, crossing your legs at the knees, and repetitive lifting of 50 pounds.

DO NOT DO ANY OF THE FOLLOWING

- Do not sit in low chairs or with your knees higher than the hip
- Do not lean forward
- Avoid extreme bending from waist. Although the risk of dislocation is less with surface replacement due to its inherent increased stability, it is still advisable that you adhere to the above precautions.

During your hospital stay, the therapist will visit you twice daily and gradually your activity level will be rapidly increased. They will also help you in determining what type of equipment you will need to use at home. Some of this equipment includes a reacher which enables you to pick up things without bending past the 90 degree restriction, a sock cone which assists you in putting on nylons and socks, a long shoehorn to help put on shoes, and equipment for bathing. The therapist will also discuss safety procedures for various activities with you. Prior to discharge, a set of instruction with diagrams will give you specific guidance on how to sit, use crutches, get into or out of bed, position a chair correctly, etc. Since you will not be allowed to bend your hip more than 90 degrees, special instructions for entering a car will be given to you as well. Every program is designed specifically for each patient and only equipment that will be useful to you will be suggested. If you have any questions, please ask your therapist and/or nurse.

The programs discussed above are for more "routine" first-time replacements. They may be altered for complex revisions. In these cases, weight bearing may be delayed.

Visitors are welcome during your hospital stay. However, they should be kept at a minimum especially during the first several days while you are recovering from surgery and need your rest. If family members and friends would like to speak with you during your hospital stay, please provide them with the hospital's main telephone number. You may have a family member sleep in your hospital room, the rooms are all private.

XIII. AFTER YOU GO HOME

After approximately 2 days in the hospital, you will be discharged to your home or possibly to a rehabilitation or extended care facility. Rarely, a home therapist or nurse is needed for a short while. It is very important that you follow the doctor's and therapist's instructions and precautions. We will send you home with a detailed written instruction sheet.

Resume your usual medications unless instructed differently. Continue to take iron pills and aspirin for one month.
Gradually increase your activity as is comfortable but be careful not to overdo it! You should use your crutches or walker full-time with partial weight bearing for about 2 to 3 weeks unless special orders have been given. You may drive an automatic car as you feel stronger and are not taking any narcotic medication. If the operative leg is the right, you must break with the left foot. You should not sit in any low chairs to attempt to bend down to put on shoes or socks or cut your toenails. A raised toilet seat should be used for about six weeks. When you sleep you should keep a pillow between your legs and not lie on either side, unless there are two pillows between your legs and you have been instructed how to roll safely toward your unoperated side.

Beginning on the second day after surgery, you may shower with a plastic dressing over your wound. This should be changed to an air permeable dressing after each shower. Ten days after surgery the dressings are no longer needed and the wound may get wet in a shower. At fourteen days post op you may remove the steri-strips. After one month, you may soak the wound in a bath, swimming pool, or spa.

The initial exercises should be gentle and low impact. Perform only the exercises taught to you twice a day. Swimming is permitted when the wound completely heals (at approximately four weeks) but avoid vigorous kicking. Assistance is needed to get in and out of the pool. We encourage a progressive walking program. Gradually increase your time daily. At 6 weeks post op we would like for you to be walking approximately 1 mile without a cane.

You may resume sexual intercourse as soon as it is comfortable but as with all activities be careful to observe the hip precautions and don't overdo it!

Approximately six weeks after your surgery you will return for a follow-up visit with special x-rays. We will progress you to the Phase 2 hip exercise program. At this time you will be allowed to sit past a 90 degree angle, put on your shoes and socks, and cut your toenails.

It is normal for swelling to be present in the operative leg for several months after surgery. If the swelling is accompanied by pain and redness or does not improve with elevation of the leg over night, notify your doctor.

A cane is recommended until you can walk without a limp. As long as you walk without support and a limp, you may do light recreational activities such as biking, playing golf and ballroom dancing. Other activities should be cleared with your doctor first. Return to work is also on an individual basis, depending upon your job requirements, type of surgery, and recovery rate.

Each program is tailored to the individual and his/her needs. Your progress may differ as determined by your doctor. If you had a revision procedure you may need to follow specific precautions for 4 to 6 months. In order to promote maximum durability it is advisable that you minimize impact as much as possible. It is also recommended that you obtain insoles or heel inserts made of impact absorbing material. Firm cushion soles are also advisable.

It is essential that a hip replacement be examined by a physician and x-rayed throughout your lifetime in order to determine the response of your bone to the implant and to detect any signs of pending failure. You should be seen post op at 6 weeks, 1 year, 3 years, 5 years, and 10 years. The length of time between follow-up visits might be lengthened depending on your condition. Patients should be prepared to have specially positioned x-rays so that the status of bone and fixation can be assessed.
XIV. LONG-TERM PRECAUTIONS

Postoperative Activity Advice

You may be able to take part in physical activities which before surgery were impossible. There is a difference between patients who have polyethylene bearings and those with metal-on-metal bearings. The problem relates primarily to wear of the plastic bearing which is analogous to tire wear. That is, the more you use it, the more wear occurs. Metal-on-metal devices have considerably reduced wear. Swimming is encouraged. However, very rough or heavy activities may shorten the life of the implant. The rotation stress on the lead leg and hip in golf may be minimized by use of a smooth spikeless shoe. Bicycling risk factors are related to the pedal stress of uphill topography. It is too soon to assess whether the adverse risks of heavy activity with new metal-on-metal surface replacements are as minimized as we hope. Your doctor, by serially following your x-rays and scans, can advise you about risk factors which may affect the life of the implant.

Infections

Infection may localize at the site of the artificial implant and can cause major complications. Therefore, if at any time you should contract an infection anywhere in your body, especially those which cause high fever, you should have it treated immediately by your physician. Special precautions should be taken for bladder infections, ingrown toenails, tooth and gum infection or when having dental work done before undergoing surgical procedures. In general, Amoxicillin 3 grams is recommended 1 hour before and 1.5 grams 6 hours after any dental procedure. If you are allergic to Amoxicillin or Penicillin, Erythromycin stearate is recommended (1 gram 1.5 - 2 hours before and 500 mg. 6 hours later). The need for special precaution during routine dental check-ups is controversial. If your gums tend to bleed during the cleaning process, antibiotics are recommended as described above. If possible, all dental work should be delayed until four months following surgery. Antibiotic coverage for other surgical procedure or infections is individualized according to the possible bacterial contamination, and therefore, you should notify the respective physician or surgeon so they can prescribe the appropriate medication.

XV. CONCLUSION

On the whole, total hip replacement has proven to be extremely successful and beneficial and a significant contribution to modern surgery. We hope that your surgery is a success and that your hospital stay is as pleasant as possible. We are confident that this booklet will help to familiarize you with our procedures and answer many of your questions. However, please feel free to contact us should you have any further questions or require additional information.

Obtained from Dr. Gross website