

Potential Complications of Orthopedic Surgery

The following list of potential complications although extensive is not all-inclusive, and other potential complications may be possible for your particular procedure. Discuss with your surgeon any additional risks he/she thinks may be important. Many of the potential complications listed below are likely to have never occurred within the practice of your surgeon. Most of the others will be rare, or infrequent.

1. Skin

Scars – Scars are a consequence, not a complication of surgery. However, some variations in scarring may be thought of by some as complications.

Length – The length of the scar will be equal to the length of the surgical incision made.

Width – The width of the scar will be determined by characteristics inherent to an individual's skin makeup, and by the orientation of the incision in relation to skin tension lines, or Langer's lines. Suturing technique and variety of suture are of less importance.

Individuals with particular skin characteristics will scar to a greater or lesser degree than individuals with different skin characteristics.

Incisions made parallel to the skin tension lines will tend to be narrower than those made perpendicular to them. Because the underlying anatomy and the malady being treated determine the proper orientation of the skin incision all incisions can **not** be made parallel to these tension lines.

Pigmentation – Initially all incisions will contain more color than the normal skin color. With light skinned races by twelve months after surgery most scars have lost this coloration and are generally slightly lighter than the normal skin.

Occasionally a scar will remain with more coloration than the normal skin. In dark skinned races scars routinely remain darker than the normal skin, but on occasion there may be complete loss of pigmentation and a near whitening of the skin (vitiligo).

Keloids – Keloids result when the body's healing response creates an excess amount of fibrous or scar tissue in the incision site. The resultant scar is wider and thicker than usual and

typically has a “heaped up” and discolored appearance. Although the thickness of the scar will decrease over time the width remains excessive and the coloration in most cases darker compared to normal. Certain skin types are prone to form keloids. Patients with a history of former keloid formation will likely form keloids in subsequent incision sites. Consultation with a dermatologist or plastic surgeon may be sought if the process becomes a cosmetic issue.

Granulation tissue (“proud flesh”) – The exuberant growth of healing tissue at the wound site sometimes “over heals” in an area leading to a red nodular growth of tissue on all or part of the wound. This may delay complete wound healing, and may require chemical cautery for its ablation and full healing.

Adherence of skin to underlying tissues. - When incisions are made where there is little soft tissue interposition between the bone and the skin (for example, over the kneecap, back of the hand or elbow, or shin), the skin may in fact heal directly to the bone. This situation can lead to an unusual puckering of the skin in the affected area when the limb is moved. Some of these adhesions can be released by repeated manual pressure, but others may persist. These adhesions are rarely painful.

2. Wounds

Wound closure – Wounds can be closed with a variety of materials/devices including metal staples, non-absorbable sutures, absorbable sutures, “steri-strips”, and others. Failure of these materials/devices prior to wound healing can lead to unwanted re-opening of the wound or **wound dehiscence**. Suture material under the skin may be able to be felt through the skin when touching the wound area. Some absorbable suture may produce a local inflammatory reaction in the wound with redness and drainage of a small amount of pus (stitch abscess). This situation should be medically evaluated. Removal of wound closure material may be associated with pain (usually minor).

Redness – Redness is one of the hallmarks of inflammation and is often seen normally at wound edges. Progressive or intensifying redness can indicate an infection and should be medically evaluated.

Bruising/hematoma – Bruising seen in the skin can occur after any surgery and is usually temporary. Bruising may not be limited to the surgery site and may actually appear quite distant to it without

consequence. Some bruising can leave permanent discoloration of the skin.

A hematoma is a collection or pool of blood within the tissues. Many hematomas will resolve spontaneously. Some will have to be aspirated (drained with a needle and syringe), or evacuated surgically.

Swelling – Swelling is a normal part of the inflammatory response to injury and surgery. Swelling can contribute to pain intensity. Excessive swelling can contribute to other complications (see 7. Compartment syndrome, and 14. Casts, braces, splints, and bandages below.)

Blisters – When there is swelling from injury or surgery, blistering of the skin in the area of injury/surgery can occur. Adhesive bandages (Steri-strips, Band-aids, etc) applied to the skin can cause blisters to form as the skin swells underneath them following surgery.

Wound drainage – Bloody or serous (clear yellow) fluid commonly discharges from a wound in the first few days after surgery and as such is a normal occurrence. Excessive, persistent drainage, or the appearance of pus can signal a wound problem and should be medically evaluated.

Fat atrophy – Loss of subcutaneous fat tissue can occur after healing of a surgical wound leading to a dimpling of the skin or a sunken area around the healed incision. This is usually a permanent change when it occurs.

- 3. Infection** – Infection rates in orthopedic surgery average at or below **1%**. In spite of sterile techniques, antibiotics, and less invasive procedures the risk of infection has **NOT** been eliminated completely. Infection risk is increased in patients who have concomitant disease processes that affect the immune system (the most frequently encountered being Diabetes mellitus). Traumatic wounds from injuries carry a higher infection risk than clean surgical wounds.

Surgical wound infections

Superficial infection – Infection involving only the skin is called cellulitis. This type of infection usually resolves with wound care and antibiotics.

Deep tissue infection -

Soft tissue abscess, and infected hematoma – These infections require further surgery to drain the infected material and antibiotics to be eradicated.

Joint and bone infection (septic arthritis and osteomyelitis) – Treatment is surgery (often times multiple surgeries), and antibiotics. When implants such as joint replacements or others are present these implants **may** have to be removed to eradicate the infection.

Infections distant to the surgical wound

Urinary tract infection – If a urinary (foley) catheter has been placed for facilitating post-operative voiding of urine a bladder infection can result.

Pulmonary (lung) infection – Post-operative pneumonia can complicate the post operative period.

Candida (yeast) infection – The use of antibiotics to prevent post-operative bacterial infection can in susceptible individuals lead to either a vaginal and/or oral (Thrush) yeast infection.

Pseudomembranous enterocolitis – Antibiotics used to prevent post operative wound infection can alter the bacterial population of the intestinal tract and lead to the flourishing of an unwanted bacteria that will cause a severe diarrheal illness called pseudomembranous enterocolitis. Serious cases of this illness can be fatal, but this is rare.

4. Thrombosis (“Blood clots”) – Any surgery that leads to a period of relative immobility can promote a situation where the blood traveling in the vessels will clot easily and inappropriately. Early mobilization of the patient when possible, and the use of pharmacological agents (blood thinners) and mechanical methods (compression devices) can decrease, but not eliminate the chance of thrombosis. Certain disease states (e.g. cancer, congenital clotting abnormalities, vascular disease, etc), obesity, smoking, and the use of estrogen products increase the risk of thrombosis. Major hip and knee surgeries are most likely to provoke undesired thrombosis, but other orthopedic procedures carry some risk of unwanted thrombosis.

Deep venous thrombosis (DVT) – Blood clotting inside the lumen of the veins of the legs (less commonly in the arms) is termed deep vein thrombosis (DVT). Large clots can impede return blood flow toward the heart in the affected limb. Many times small DVT are asymptomatic, however larger DVT can lead to temporary swelling, pain, and altered circulation of the extremity. In severe cases of DVT the symptoms can become chronic and lead to persistent pain, skin

fragility and breakdown, and poor function of the extremity (Post-phlebotic syndrome).

DVT in orthopedic surgery when it occurs is most often treated early enough to avoid chronic side effects.

Pulmonary embolism (PE) – When a clot that has formed inside a vein becomes loose inside the vein lumen it is free to travel up the vein, pass through the heart, and ultimately be filtered out by the vessels of the lung. Once in the lung the clot is termed a pulmonary embolism (PE). The larger the vessel that is obstructed the more the blood flow through the lungs is decreased. Large obstructions of blood flow through the lungs can cause death.

Symptomatic pulmonary embolism is uncommon in orthopedic surgery, and fatal pulmonary embolism is rare.

5. Blood loss

“Normal” blood loss – Blood loss is expected anytime an incision is made. The amount of blood loss expected from a surgery varies with the area of the body involved, the tissues involved, and the length of time of the procedure. Your surgeon can inform you as to whether the planned procedure will produce blood loss likely to lead to a **transfusion**.

Abnormal blood loss – Occasionally blood loss during surgery is more than is expected. Patient factors (e.g. medications), disease factors (e.g. alterations in coagulation), and injury factors (e.g. vessel injury) can all be involved when blood loss is more than expected. This blood loss can on rare occasion lead to amputation or death.

Vessel injury (Artery and veins) – Vessel injury can occur incidental to an injury or to surgery itself. Small vessel disruption is common and purposeful during surgical exposure and dissection and is usually treated with coagulation of the vessel. Rarely a large vessel will be traumatized and require repair by a vascular surgeon. Large vessel injury can lead to gangrene, amputation or death.

6. Nerve injury – Nerves can be injured during surgery either directly or indirectly. Direct injury where a nerve is cut by the surgeon is most common in the skin, and often occurs during the surgical approach (see Cutaneous nerves below). Larger nerves are rarely affected by direct surgical injury. Indirect injury can occur during surgery when nerves are retracted to

keep them away from direct injury. Sometimes this act of holding the nerve “out of harms way” can produce enough tension itself to cause injury.

Indirect injury can likewise occur from increased pressure on nerves from postoperative/post-injury swelling. Scar formation around nerves following injury/surgery can produce nerve injury as well. Nerve injury can also lead to chronic regional pain syndrome (CRPS). The effects of any nerve injury can be temporary or permanent.

Cutaneous nerves – Small skin nerves that lie in the path of standard surgical incisions are severed during the incision, and lead to permanent loss of sensation in small areas of skin on one or both sides of the incision. The most notable location where this is encountered is on the front of the knee where a vertical incision will always leave an area of numbness on the outer side of the incision. **Any** incision can produce a permanent area of skin numbness. This then is felt to be a normal outcome of the surgery.

Deep nerves – Larger nerves that control both motion and sensation can be injured leading to both **paralysis** of muscles and **anesthesia** of the skin. Depending on the extent of the injury these problems can be temporary or permanent.

Spinal cord – Spinal cord injury can lead to large areas of complete or partial paraplegia or quadriplegia. This is a rare outcome of spinal surgery.

7. Compartment Syndrome – Following an injury or surgery swelling can lead to increased pressure within an arm or leg. When this increase in pressure is sufficient to cause severe pain, altered blood perfusion, and nerve dysfunction there is a compartment syndrome. Treatment is a surgical release of the pressure. Skin grafting may necessary subsequent to the surgical release. Effects of compartment syndrome can be paralysis, a withered limb, gangrene, amputation, or death.

8. Joint stiffness – Scarring that occurs around the joint following an injury and/or surgery can lead to stiffness and decreased range of motion of the affected joint. This may be temporary or permanent.

9. Post-traumatic arthritis – When a joint has been involved in any injury or surgery there may develop arthritis in that joint at some future date. Pain, swelling, stiffness, and loss of function are hallmarks of arthritis affecting the joint. When destined to occur because of injury to the joint it cannot be reversed.

10. Malunion – Fractures that heal in a position or alignment that varies from the normal position or alignment are called malunions. Mild malunions affect neither appearance nor function. Malunions that affect bone growth, impede function, or produce deformity may need further treatment.

11. Non-union – Fractures that do not heal with or without treatment are non-unions. Some non-unions are inconsequential, whereas others require aggressive surgical treatment.

12. Osteonecrosis (Avascular Necrosis (AVN)) – An area of bone that has lost its blood supply can die and ultimately lose its structural integrity. This process is called osteonecrosis. Loss of blood supply is usually the result of an injury or disease process. The surgical approach necessary to access some parts of the anatomy can also contribute to osteonecrosis.

13. Heterotopic Ossification – In response to injury and/or surgery certain soft tissues may produce bone where no bone has existed before. This mass of bone may be variable in size and can lead to symptoms of pain, and limited range of motion. In some cases excision of the boney mass when it matures may be warranted.

14. Implant Failure – Orthopedic surgery utilizes many materials that are implanted within the body for the repair and reconstruction of injury and disease. These materials fall into two categories: biologic, and “mechanical”. The biologic materials utilized can be taken from the patient him/herself (autograft), from another human (allograft), or from another animal species (xenograft). Some are also manufactured directly. Mechanical, or non-biologic, orthopedic implants can be made of metal, ceramic, plastic, or various synthetic polymers (dacron, nylon, etc.). Failure of implanted materials can lead to local and systemic problems, and may necessitate further surgery and other treatments.

Biologics

Autografts – These tissues may fail acutely or after a period of successful function. Failure can occur within the material itself or at its attachment site to the local tissues.

Allografts/Xenografts – These tissues can fail similarly to autografts. In addition they may also provoke a reaction within the body, either allergic or tissue rejection, that may lead to the

implant's failure and other systemic abnormalities. Infections have also been the result from such tissues in spite of collection and processing methods devised to prevent such an occurrence. Some of these infections can be fatal.

Manufactured biologics – These may fail in their intended function by either breakage or tissue reaction.

“Mechanical” implants

Metals– Pins, screws, plates, rods, and joint replacement implants are wholly or partially metal. Despite the known strength of metals they can **fail** (often by a manner similar to bending a wire back and forth until it breaks). Metals can also **wear** and/or **corrode**. This can lead to **breakage**. Wear and corrosion can also lead to the release of metal **ions** into the tissues and general circulation. No serious effects of these metal ions on the body have been shown; however, the role of these ions in the body once released is the subject of ongoing investigation. **Allergic reactions** to implanted metals are suspected to occur rarely, but if present are currently very difficult to diagnose.

Pins are usually stainless steel wires. They may bend, break, or loosen. They are often smooth and may migrate from their initial position of implantation. This migration can sometimes injure other body parts. The need for pin removal, +/- repair of injured structures, or +/- re-implantation may ensue as a result of pin failure/migration.

Screws may irritate surrounding tissues and need to be removed. Stripping of a screw head during insertion or attempted removal may prevent easy removal, and lead to a more involved procedure for its ultimate removal if warranted. They may bend, break, or loosen requiring a revision surgery.

Many **plates** and the screws that hold them in place should be removed. Removal should take place after healing and remodeling of the fracture. Plates can bend or break requiring a revision surgery. Plates when left in place on the bone for extended periods can lead to softening of the bone directly under the plate and another fracture, usually occurring through the bone at one end of

the plate. This is most problematic with weight-bearing bones of the lower extremities.

Rods should be removed if they produce symptoms or are associated with an established non-union of a fracture, otherwise they can remain indefinitely. They can bend, break, or loosen requiring a revision surgery.

Joint replacement implants can wear out or become loose requiring their removal and revision to a new prosthesis.

Ceramic – Ceramics are more brittle than metals, and although very strong, they can break. Wear particle release and allergic reactions are possible. Ceramic failure can lead to revision surgery.

Plastics and Polymers – These implants are softer and more pliable than metals and ceramics. They can all fail, and in doing so require further surgery. Wear particles and fragments from these materials can migrate within the body leading to local as well as systemic reaction.

Instrument breakage – A complex array of instrumentation is utilized for the application of all these orthopedic implants, and all these instruments are subject to possible breakage and/or malfunction as well.

15. Casts, braces, splints, and bandages – Orthopedic surgeons often employ these devices in the peri-operative period as a necessary adjunct to surgical treatment. With all these devices local irritation can occur leading to rashes, blisters, open sores, or aggravation of swelling. Any type of device or dressing that encircles a limb can restrict outward expansion of that limb when swelling occurs. In such cases pressure can escalate within the tissues and lead to severe pain, and in rare cases **compartment syndrome** (see 7. above). Any focal or general problem related such a device should undergo medical evaluation.

16. Pain – All surgical procedures produce pain. Responses to pain for a given type of surgical procedure vary widely among patients. Response to pain relievers is similarly widely variable among individuals.

Acute pain – This is the pain that is associated with injuries and/or surgeries. This is usually most prominent the first 48-72 hours after the inciting event, and tapers off predictably in the 2-6 weeks

following injury or surgery. Peri-operative pain control measures typically reduce, but do not always eliminate pain.

Chronic pain – Pain can persist chronically after an injury or surgery. This type of pain can be caused by scarring, the development of arthritis, infections, allergic reactions, tissue rejection phenomena, or complex regional pain syndrome (CRPS). These painful processes can require chronic treatments and possibly referral to a pain management specialist.

17. Fractures and Tissue damage – Attempts to surgically correct problems with bones, joints, or adjacent soft tissues can lead to additional damage to these structures themselves. An example of such an incident would be when the placement of a screw or other fixation device causes the splitting or fracture of the bone it was intended to fix.

18. Pressure sores (Bed sores) and Pressure phenomena – Periods of relative immobility in a single position can lead to pressure being maintained on relatively small areas of skin for a long enough time to lead to a breakdown of that skin known as pressure sores. Areas most commonly affected are the heels and the buttock region. Frequent changes in position may prevent this problem. Assistance from the nursing staff will often be needed to accomplish these position changes. These sores if they develop will routinely need additional treatment for their resolution.

While a patient is anesthetized for surgery body parts that are susceptible to pressure will be padded to avoid injury to them. These include bony prominences, nerves, eyes, ears, face, and genitalia. Pressure injury can occur to these areas **even when they are adequately padded**. This is most commonly seen with procedures of long duration and/or those associated with large blood losses.

19. Damage to internal organs – Spinal and pelvic/hip surgeries carry with them a risk of damage to the organs of the chest(heart & lungs), abdomen(liver, spleen, kidneys, digestive organs), and pelvis(urinary, reproductive, and digestive organs), and the large blood vessels therein.

20. Electrical injury and burns – Much of the equipment utilized in surgery is powered by electricity. Correspondingly it is possible to sustain an electrical injury, burn, or combustion related injury. Proper grounding and other precautions are in effect to minimize the risk of such an injury.

21. Medical complications - Heart attacks, heart failure, irregular heart beat (arrhythmias) , **strokes**, kidney failure, respiratory (**lung**) failure, gastrointestinal bleeding, **allergic reactions**, malignant hyperthermia, and many other medical problems, even **death** have all been reported in the operative or post-operative period. The risks of these medical complications increases with patient age, and with both known and unknown medical problems present in the patient.

22. Anesthetic complications – These risks can and should be described to you by your anesthesiologist.

23. Human error – The operating team is principally made up of the surgeon, anesthesiologist, assistant surgeon/physician assistant, scrub technician, circulating nurse, and recovery room nurse. Also involved in every case are sterile processing personnel, and operating room custodial/maintenance personnel. Other ancillary personnel that may contribute include anesthesia technicians, radiology technicians, and implant/instrument vendor personnel. An error on the part of any one or more of these persons could lead to a patient complication. Protocols and procedures are in place, and are adhered to which minimize such errors.

Addendum I. - Total Hip Replacements

The technical goals of Total Hip Replacement (THR) are to have the prosthetic components optimally aligned within the bones, and securely fixed to the bones. The goal of normalized leg length is desired and routinely achieved, but on occasion may have to be compromised in order to provide for the desired stability of the joint, that is to prevent dislocations of the joint. When these goals are met pain is usually greatly decreased and function is greatly improved in the majority of patients undergoing THR.

In addition to those complications listed in 1 through 22 above one may experience other complications with THR such as dislocation of the hip joint or joint instability, peri-prosthetic fracture of a bone during implantation of the prosthesis, persistent limp, abnormal leg length, and/or altered alignment of the lower extremity.

Addendum II. - Total Knee Replacements

The technical goals of Total Knee Replacements (TKR) include normalization of lower limb alignment, optimal orientation of the prostheses on the bones, and secure fixation of the prostheses to the bone. Physiologic

range of motion, and soft tissue tension of the knee joint are approximated as closely as possible.

In addition to those complication listed in 1 through 22 above one may experience other complications with TKR including dislocation of the joint or joint instability, peri-prosthetic fracture of a bone during implantation of the prosthesis, persistent limp, incomplete or limited range of motion of the knee joint, and/or altered alignment of the lower extremity.

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