



Anesthesia and Pain Control for Osteointegration Implantation Into the Femur

Stage II Osteointegration Implant (OI) Skin Coupling Procedure

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The success of our index case employing the use of the Osseointegration Implant (OI) is largely due to the coordinated efforts of the assembled team of medical professionals including nursing, surgeon and anesthesiologist. The anesthetic methods and techniques were a central component of each of this patient's surgeries. This is a report of the anesthetic methods employed in managing this patient's pain before, during and after the implantation with the novel Longitude™ OI device.

The index patient was well known to the team having undergone multiple prior surgical procedures at our institution. This report will detail the anesthesia provided at the time of the transfemoral amputation, followed by the Stage I implantation of the Longitude™ OI device and finally concluded at the time of the stage II docking through the skin procedure. In each case the patient was offered neuraxial subarachnoid block [1] and declined.

Medical History

The patient was a 65 year old female at the time of the transfemoral amputation. The patient was in a well managed state of health, with routine long term out patient care by her Internist. She had been diagnosed with essential hypertension that was well controlled with oral furosemide 20 mg daily. She had a history of latex allergy with both cutaneous hypersensitivity and systemic anaphylactic reactions on contact with latex on multiple prior occasions. The patient had been diagnosed with Juxacortical Chondrosarcoma of the right distal femur prior to her planned elective transfemoral amputation. She had



undergone multiple prior surgeries to remove the tumor from the right lower extremity starting with the first attempt at the age of 16 years. The diagnosis of a malignant cartilage lesion was not confirmed until a few months prior to the planned right transfemoral amputation. For these reasons the patient was assigned an American Society of Anesthesiology Score [2] of 3, severe systemic disease.

The patient's prior anesthetic episode records were reviewed, the patient had tolerated all prior procedures and anesthetics without complication.

Right Transfemoral Amputation

The patient was taken to the operating room (OR)

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and standard non-invasive monitors were applied, and pre-oxygenation by face mask was initiated. Pre-operative antibiotics were administered intravenously (iv) upon OR entry, about 15 minutes prior to skin incision [3]. In accordance with the Joint Commission's universal protocol for the prevention of wrong site, wrong surgery and wrong person guidelines the operative limb was confirmed by the anesthesiologist, the operative surgeon, the circulating nurse and the surgical technician by review of the written history and physical, the signed consent for surgery, patient interview/questions as well as the surgeon's initials at the surgical site [4].

Once the surgical site had been confirmed the patient was dosed with 250 mcg of Fentanyl [5], 10 mg metaclopramide [6] and 20 mg Famotidine [7]. After two minutes of pre-oxygenation, 100 mg lidocaine [7] was given iv, followed immediately by 200 mg propofol. 30 seconds later, a Laryngeal Mask Airway [8] (LMA) was inserted orally; the LMA had been pre-treated with 2% lidocaine [7] jelly. End tidal carbon dioxide tracing was confirmed and hand ventilation was initiated to assist ventilation and to maintain oxygen saturation [9]. Subsequently, as the patient began to ventilate spontaneously and oxygen saturation was greater than 97%, vaporized inhaled desflurane [10] was initiated for maintenance of general anesthesia. The surgery proceeded without complication. The surgeon injected sciatic nerve with 10 ml of 0.25% bupivacaine [15] with epinephrine prior to ligation and transection. As surgical dressings were applied and the desflurane discontinued and the patient aroused adequately to allow removal of the LMA. The patient was observed to ventilate spontaneously. Nausea prophylaxis was given in the form of ondansetron [11] 4.0 mg iv. The patient was recovered in the Post Anesthesia Care Unit, and was subsequently transferred to the orthopedic ward for in patient care.

Stage I: Implantation of OI implant into the residual femur

The second surgery occurred approximately two months later. This surgery involved implanting the OI device into the remaining femur. The anesthetic technique was identical to that which was employed during the amputation. The patient's peri-operative care was uneventful.

Stage II: Coupling the OI implant through the skin

The third surgery occurred approximately 123 days after the Stage I procedure, and involved the coupling or exteriorization of OI implant through the skin of the right transfemoral amputated limb. The patient agreed to undergo an anesthetic technique employing a femoral nerve block, along with moderate sedation.

The surgical site confirmation protocol [4] and prophylactic antibiotic [3] pre-medication steps were performed per standard protocol prior to any invasive steps. The nerve block was performed in the pre-operative holding area. 4 mg midazolam [12] was given iv as the skin was prepped and draped in a sterile fashion. Ultrasound guidance was used to locate the femoral vessels and nerve [13]. The skin was anesthetized with 2% lidocaine [14] and a 22 gage stimulator needle was visualized immediately lateral to the femoral artery. There was no electric nerve stimulator utilized during this nerve block. A total of 30 ml of 0.5% bupivacaine [15] with epinephrine was injected in 5 ml aliquots surrounding the femoral nerve. There were no parasthesias and aspiration before each 5ml injection was negative.

After induction of anesthesia the surgeon infiltrated the operative site with a cocktail of ketorolac [16] 30 mg, morphine [17] 10 mg and ropivacaine [18] 40mg with saline in a total volume of 60 ml via a 10 cm 18 gauge needle. Intra-operative sedation consisted of 100 mcg fentanyl [1] iv and a total of 200 mg propofol [19] given incrementally throughout the course of the anesthetic episode which lasted approximately 90 minutes. During the intra-operative care, the patient maintained spontaneous ventilations breathing oxygen via a standard face mask with an oxygen flow of 10 liters per minute. The patient required no airway support of any kind, recovered uneventfully and was transferred to an orthopedic in patient ward.

Post Operative Care

The patient was held on an orthopedic ward for 20 hours after the surgery. A Patient controlled anesthesia [20,21], (PCA) device loaded hydromorphone [22], set to deliver a demand dose of 0.2 mg at a 10 minute lock out, no loading dose, no continuous infusion, was provided for the first 16 hours after surgery. The patient used the PCA for a total of 3 demand doses of hydromorphone [22] over the first 8

hours after surgery, then none further was required. The PCA was discontinued at 0700 the next morning and the patient was transitioned to oral hydrocodone [23] 5mg/acetameniphen [24] 325mg prior to discharge. The patient was also advised that ketorolac 12 IM supplemental pain control was available but it was not required for any break through pain control. A single dose of ondansetron [7] 4.0 mg IV was required for nausea about 9 hours post surgery.

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