POST-TRAUMATIC OSTEOMYELITIS OF THE PATELLA: A CASE REPORT

Timothy John S. Chua, MD-MBA[1]
Ruperto O. Estrada Jr., MD, MHA, FPOA, FPCS[2]

BACKGROUND

Post-traumatic osteomyelitis (OM) is commonly seen in the setting of an environment with overpopulation and limited resources. Compounding this is the chronicity of the infection due to the lack of medical follow-up and/or recurrences despite on-going intermittent treatments. That never-ending cases of OM continue to be encountered at a government hospital as a sequelae to increasing vehicular crashes and occupational accidents is an understatement; however an occasional rare clinical case is both a challenge and an opportunity to learn for trainee and attending physicians alike. Here we present a case of post-traumatic OM of the patella persisting over a course of five years.

CASE PRESENTATION

Our case starts with that of a healthy 23-year-old male, right-handed, employed as an acolyte, who sustained an open fracture of the inferior pole of the right patella due to a vehicular crash in 2017. He was brought and managed at the Philippine Orthopedic Center (POC). Two formal debridement were done 1 week after another. After the knee wound healed the following month he underwent fracture fixation using braided nonabsorbable sutures (Ethibond®) along the method described by Saltzman et al. **[20]** Stapled were removed two weeks after and wound healed completely. 6 months after initial injury, patient consulted because of persistent swelling, unusual pain and an anterior draining sinus on the right knee. He was afebrile. Debridement was again performed on March 2018. Wound healed completely two weeks after, but recurrence of symptoms prompted consult and then debridement was again performed 14 months after on May 2019 totaling 20 months from initial injury. The last two debridements noted with excision of some of the Ethibond® 5 sutures. Patient sought consult again October 2022, now 5 years and 1 month from initial injury and 3 years and 5 months from last debridement, because of the recurring symptoms. On this most recent consult he was ambulatory with an antalgic gait on right and his knee was moderately swollen, tender, with healed medial and lateral operative scars and draining sinuses along the anterior supero-medial, infero-lateral and infero-central aspects of the knee (Fig 1A). The patella was mobile; there was an extension lag of 10° and maximum flexion of 90° (Fig 1B). The radiographs show opacity along the anterior third of the patella, and osteopenia in the body (Fig 1C).

Figure 1A

Figure 1B

Corresponding author: ROEJ, bodiestrada@gmail.com

[1] Medical Officer 3, Department of Orthopedic Surgery, POC
[2] Medical Specialist 4 (ret.), Department of Orthopedic Surgery, POC

Figure 1C

Figure 1. (1A pre-operative soft tissue images from left to right: anterior, lateral and medial); 1B pre-operative range of motion; 1C pre-operative radiographs)

A plain magnetic resonance imaging (MRI) scan done on October 18, 2022 had the following findings: findings in the patella and anterior aspect of the medial femoral condyle, consistent with osteomyelitis; myositis/reactive edema in the medial and lateral vasti muscles; minimal joint effusion with synovial thickening; small baker's cyst. The knee MRI impression has findings consistent OM of the patella and medial femoral condyle. The MRI sagittal view (Fig. 2A) and coronal view (Fig. 2B) highlights the possible sinus tracts which contains retained sutures and purulent material. In Figure 2C, the axial MRI shows the tunnels made from the previous surgery using nonabsorbable sutures. His relevant hematology tests results were as follows: leucocyte count 7.45 x 10^9/L (normal 4.8 - 10.8 x 10^9/L), neutrophil count 0.49 (0.40 – 0.74), erythrocyte sedimentation rate 22 mm/hr (< 15 mm/hr) and C-reactive protein 2.7 (< 10 mg/L). Pseudomonas aeruginosa was isolated from the draining fluid; he was then started pre-operatively on ceftazidime 2 gm intravenous every 8 hours upon recommendation from the Infectious Disease internist.

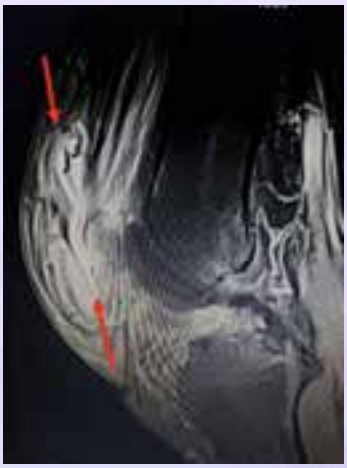
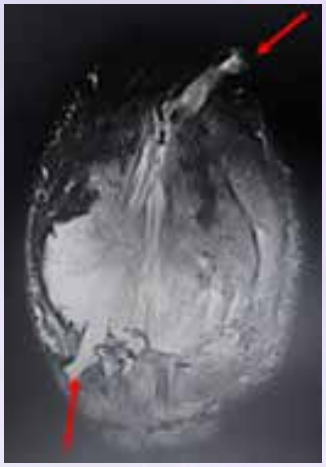


Figure 2A



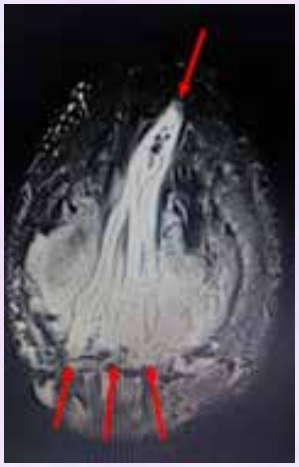


Figure 2B

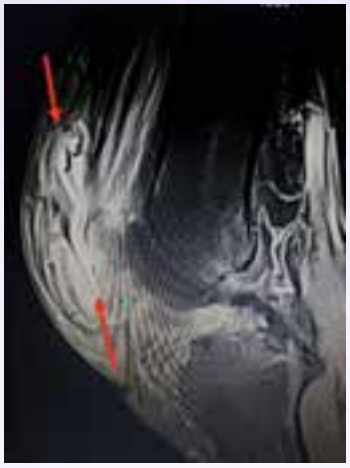


Figure 2C

Figure 2. MRI cuts (2A sagittal MRI, 2B coronal MRI, 2C axial MRI) red arrows pointing to sinus

Intra-operatively there was no purulent material. The three sinuses were debrided clear of their slimy peripheries. The right knee was surgically approached utilizing the standard midline vertical incision. The intact knots of the sutures were situated at the superior surface of the patella; it was initially difficult to locate them because of the covering infected fibrosis (Fig. 3A). The sutures were covered with a slimy translucent film throughout their lengths inside three vertical through-bone tunnels. We were careful 1) to avoid accidentally slicing any suture before the tunnel entrances and exits were exposed and 2) to avoid totally peeling the quadriceps tendon from the patella (Fig. 3B and 3C). Tunnels were curetted clear of the slime after all sutures were believed to be removed; these curetted matter were collected for bacteriology cultures (Fig. 3D). The patellar tendon was attached intact along the inferior pole, to the best of our visual and tactile inspection. We recovered a 2.0 x 1.5 cm ossicle attached along the lateral femoral condyle which was later determined by the pathology report as a benign fibro-osseous tissue (Fig. 3E). The medial femoral condyle did not manifest with any osseous change that was reported on the MRI scan as suggestive of COM so we avoided opening it up. The dissected quadriceps tendon portion was re-attached to the superior patella, covering the tunnels. Before skin closure the knee was passively fully extended up to flexion enough for 90°.

Post-operatively the extremity was placed on a temporary knee immobilizer with the patient to full weight-bear as tolerated on crutches. The operative culture result was heavy growth of P. aeruginosa. The ID internist reviewed the results and prescribed intravenous ceftazidime to continue a total of two weeks since admission, repeat of serum creatinine and oral ciprofloxacin to consume for a total four weeks as

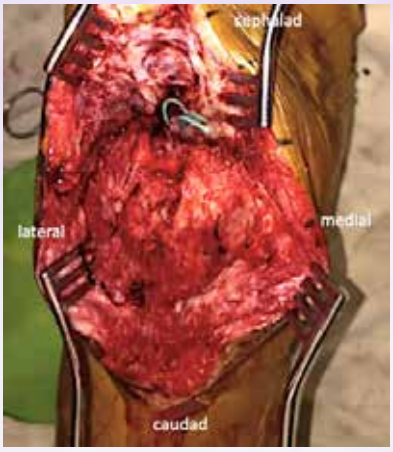


Figure 3A

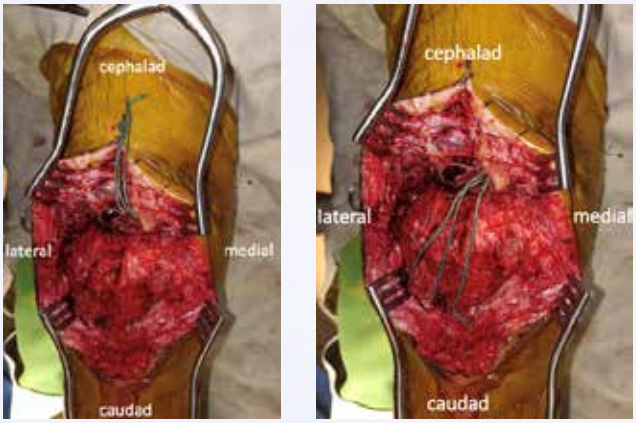


Figure 3B

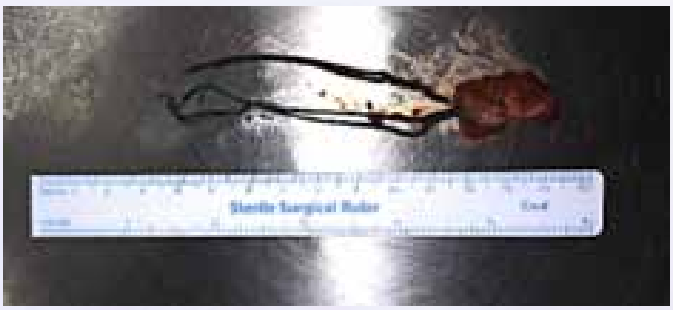


Figure 3C

Figure 3D

Figure 3E

Figure 3 (3A fibrosis; 3B non-absorbable sutures within the patella; 3C specimen of sutures ; 3D tunnels through patella; 3E medial femoral condyle specimen)

home medication. The patient's 5 month follow-up on May 2023 showed well healed wound and sinus scars. Patient was fully ambulatory with no assistive devices nor gait deviations exhibited full active knee extension against gravity and knee flexion up to 110° (Figure 4 A-C).

DISCUSSION

Figure 4A

Figure 4B

Figure 4C

Post-traumatic osteomyelitis of the patella is seldom encountered in orthopedic practice **[1,18,23]** because of generally improving healthcare systems and continuous advances in open fracture treatment. The clinical diagnosis should not be too difficult to achieve because it is associated to two risk factors, namely open trauma and previous surgeries, although a deranged immune status should not be ruled out. This is in contrast to isolated hematogenous patellar OM which is rarer **[2,9,19,21]** and confounding to diagnose because the commonly affected are erstwhile healthy juveniles and adolescents, clinical features are non-specific, the needle aspirate is negative and helpful radio-imaging technology may not always be available.

An open fracture is initially contaminated by skin flora, e.g., coagulase-negative *Staphylococcus* or by environmental microbes, e.g., *Bacillus* spp.; the major isolate recovered from a subsequent bone infection in the hospital setting is mostly a Gram-negative organism. Bacteria can hardly survive in healthy intact tissue because of adequate host defense mechanisms and they need sufficiently damaged soft tissue and bone to proliferate. P. aeruginosa is a highly adaptable organism found in a variety of surroundings. Water acts significantly in this organism's circulation; it can survive in dry inanimate or wet surfaces from six hours to a year . **[6,16]** It has the capacity to utilize simple organic molecules as an energy source thus having minimal nutritional requirements. **[5]** Once it has penetrated the damaged skin it can easily adhere—initially as scattered units-- to surfaces such as devitalized patellar spicules and frayed tendon awash in fracture hematoma. It transfers to adjacent tissue due to its one or more polar flagella. **[24]** After aggregating *P. aeruginosa* can survive by means of intrinsic antibiotic resistance, efflux systems, biofilm generation and quorum sensing, among others. **[15,17,25]**

The continued presence of a foreign body, Ethibond® (Ethicon Products, Johnson and Johnson Med Tech, Manila) in this case, contributed to the persistence of infection. Ethibond® is comprised of polyester fibers braided into a multifilament strand for high tensile strength, coated with polybutyrate in order to mitigate slicing through soft tissue and endowed with a low tissue reactivity . **[3]** Its organic and foreign nature will always elicit a minor immune response however biocompatible it is. A heightened foreign reaction in a few patients whom we cannot reliably foresee occurs, something similar to a hypersensitivity reaction to an antigen. This hypersensitivity reaction is associated to the inheritance of predisposing human leukocyte antigen genes. A foreign body reaction would elicit an immune response of release of macrophages which will clump together to form a giant cell and several of these cells clump to help generate a granuloma. Several localized foreign body granulomas thus may longitudinally cluster to form an eventual discharging sinus. Additionally multifilament braided sutures with its wider surface area and minute crevices predispose to more bacterial adhesion. Unexpected reactions reported with Ethibond® utilization in surgery have involved Achilles tendon repair **[10]** , distal biceps tendon repair **[22]** , open rotator cuff repair **[28]**, abductor reattachment during total hip arthroplasty **[8,11]** and tibialis anterior tendon transfer. **[7]**

Successful treatment of this chronic infection-foreign body reaction is attained with the complete removal of infected tissues and the Ethibond® sutures , something not done earlier. Perhaps the reason for this was the apprehension that the infected inferior pole repair might not sustain the stresses of activities of daily living for this young man without the sutures. The literature and current medical practice opinions after all does not mention a definitive time frame for removal. Indeed in-vitro models suggest that mechanical damage of a bone is required for pathogenic bacteria to gain a foothold. **[26]** With the infection occurring early on after the Saltzman procedure, the time frame for tissue healing was expected to be delayed. What could have been done in the senior author's opinion--to determine if the inferior pole fracture was united and/or if the patellar tendon was not dehisced from the patella--was to perform static and dynamic ultrasound imaging on the patella-tendon junction at knee extension and flexion, and to compare it to the normal knee **[4,14]** or to compute for the Insall-Salvati and Blackburn-Peel indices of both knees as an indirect method to estimate bone-tendon junction integrity. On the other hand the treatment philosophy of our trauma service for inferior pole fractures is to determine if the anatomical integrity of the patella can be preserved. Inferior pole excision and tendon realignment-reconstruction shortens the tendon predisposing to patella baja and increases the pressure on the patella-femoral joint surfaces.

Finally, by employing short-term parenteral therapy followed by oral antibiotics notwithstanding a virulent microbe, we were able to clinically arrest, not successfully treat, the infection since OM can recur years into the future. Interest is picking up although there is hardly uniformity in the studies mentioned in literature. Laghmouche et al reviewed a large patients cohort with *P. aeruginosa* osteomyelitis admitted to a university hospital over a 15-year period. Sixty-seven patients were included. Polymicrobial infection was predominant (63%). Except for one patient, the rest underwent surgery and antibiotic therapy. The success rate was 79.1%. The antibiotic treatment had a mean duration of 45 days (range, 21-90 days). Single-antibiotic therapy was preferred in nearly all cases. Treatment failure was reported for 14 (21%) patients and was due to the persistence of P. aeruginosa in four cases. **[12]** Voon et al reported on a healthy 66-year-old

male who underwent repair of the extensor mechanism using Ethibond® sutures. It became infected with Staphylococcus aureus resulting in patellar OM, septic arthritis and inferior pole avulsion. He underwent open debridement three months later; there was no report regarding Ethibond® sutures removal. He was placed on parenteral therapy for two weeks and oral antibiotics for six weeks and had clinically recovered by ten months. **[27]** Li et al enrolled 527 adult participants to receive parenteral therapy for various bone and joint infections and the same number to get oral antibiotics, both groups for a period of six weeks each. Treatment failure occurred in 14.6% in the intravenous group and 13.2% in the oral group. Missing end-point data (39 participants, 3.7%) were imputed. The intention-to-treat analysis showed a difference in the risk of definitive treatment failure (oral group vs. intravenous group) of −1.4 percentage points (90% confidence interval [CI], −4.9 to 2.2; 95% CI, −5.6 to 2.9), indicating noninferiority. The incidence of adverse events was not significant, 27.7% for the parenteral group and 26.2% to the oral group. Oral antibiotic therapy was noninferior to intravenous antibiotic therapy when used during the first 6 weeks for complex orthopedic infection. **[13]** Altogether the efficacy, uniformity and safety of this approach in adults need further study and the causative organism/s must be identified, something not always achievable in open fracture management.

SUMMARY

A healthy 23-year-old male sustained an open fracture of the inferior pole of the patella which was repaired using Ethibond® 5 sutures and which developed early surigical site infection and osteomyelitis. The causative organism was Pseudominas aeruginosa. Four debridements in a span of five years failed to control the infection. On the sixth operation all the remaining Ethibond sutures were removed and he was placed on short course parenteral and oral antibiotic therapy. On his last follow-up 5 months later he was asymptomatic and ambulatory with ability to perform his activities of daily living.

DISCLOSURE

None

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