Case Report

A Novel Case of Recurrent Hemarthrosis Following Knee Arthroscopy in a Patient with Undiagnosed Hemophilia

Benjamin J. Levy, M.D., Karen Sperling, M.D., Jennifer Davila, M.D., and I. Martin Levy, M.D.

The purpose of this study was to raise awareness and recommend management of a rare but morbid complication following knee arthroscopy: recurrent hemarthrosis in the setting of previously undiagnosed hemophilia. A 17-year-old male without prior personal or family history of bleeding disorders underwent an uneventful partial lateral meniscectomy and had several subsequent episodes of hemarthrosis beginning 10 days after surgery. This study helps to elucidate a strategy for diagnosis and management of this uncommon but morbid complication. A heightened level of suspicion for possible underlying coagulopathy and early involvement of the hematology service are of paramount importance in the management of patients with unexplained recurrent hemarthrosis following routine arthroscopic procedures.

Knee arthroscopy, specifically meniscal debridement and repair, is one of the most commonly performed surgical procedures in the United States. In general, these procedures are performed on an outpatient basis, and they have very low complication rates.[1] A recent analysis has placed the overall complication rate of arthroscopic knee procedures at approximately 1%.[1] Although these rates are quite low, it is essential that surgeons and treatment teams remain aware of and responsive to rare, but sometimes significant, complications. Hemarthrosis following arthroscopy is not rare, but recurrent hemarthrosis is uncommon.[2,3] Recurrent hemarthrosis may be related to unidentified vascular injury, pathoanatomy or an underlying clotting disorder.

Hemophilia A (Factor VIII deficiency) and Hemophilia B (Factor IX deficiency) are X-linked inherited disorders of coagulation. Hemophilia A is more common and affects 1 in 5,000 male births.[4,5] Disease severity is based on the amount of circulating factor levels in plasma and is defined as severe (< 1%), moderate (2%-5%) and mild (6%-40%). Patients with moderate or severe disease often present with their first bleeding episode before the age of 2 years. However, mild hemophilia may go undiagnosed for decades and not present itself until the patient undergoes a significant hemostatic challenge (e.g., trauma or surgery).[6] The orthopaedic implications of hemophilia are well described, most notably bleeding in the musculoskeletal system, usually intra-articularly. Hemarthrosis is the most common presentation of bleeding episodes in patients with hemophilia.[7]

In this case report, we present a young male, a recreational athlete who experienced significant painful, recurrent hemarthroses following routine knee arthroscopy.

Case Report

A 17-year-old male injured his right knee playing basketball in July of 2019. He was seen in our clinic in October with complaints and a physical examination that were consistent with a tear of his lateral meniscus. MRI confirmed the presence of a radial tear in the middle third of the lateral meniscus. Because of the patient's persistent pain during activities, he was indicated for arthroscopy and partial lateral meniscectomy. During his routine preoperative evaluation he denied an abnormal medical history, specifically denying any

From the University of Connecticut, Department of Orthopaedic Surgery, UCONN Health (B.J.L.), Farmington, Connecticut; Department of Radiology, Albert Einstein College of Medicine/Montefiore Medical Center (K.S.), Bronx, New York; Department of Pediatrics, Division of Hematology, Albert Einstein College of Medicine (J.D.), Bronx, New York; Department of Orthopaedic Surgery, Albert Einstein College of Medicine/Montefiore Medical Center (I.M.L.), Bronx, New York.

The authors report that they have no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received February 25, 2020; accepted March 12, 2020.

Address correspondence to Benjamin J. Levy, M.D., Department of Orthopaedics, UCONN Health, 263 Farmington Avenue, | Farmington, CT 06030-4037, USA. E-mail: levyben88@gmail.com or blevy@uchc.edu

2666-061X/20285

https://doi.org/10.1016/j.asmr.2020.03.001

personal history of bleeding. A sample of his blood was sent for a complete blood count, basic metabolic panel, activated partial thromboplastin time (APTT), and prothrombin time, and his urine was sent for routine analysis. Only his APTT was found to be mildly elevated, and with no bleeding history in the past, this was considered to be an incidental finding.

He underwent an uneventful partial lateral meniscectomy of the inner one-third of the midbody of his lateral meniscus, which was performed by a fellowship-trained orthopaedic sports-medicine surgeon. The procedure was accomplished without the use of a tourniquet. There were no intraoperative or perioperative complications, and he was discharged from the postoperative care unit with his pain well controlled by acetaminophen and ibuprofen.

The patient was seen in the clinic the next day for his first scheduled postoperative visit. His pain remained well controlled, there was a minimal knee effusion, and his postoperative dressing and wounds were clean and dry. He was walking, full weight-bearing, with crutches for protection from a fall. He was asked to start gentle exercises and began walking without the aid of crutches. He was seen again on postoperative day 8. He had a very small effusion and was walking normally without aid. His portal sutures were removed uneventfully.

On postoperative day 11, the patient presented to the emergency department with significant pain and severe swelling of the knee. On examination, his knee ligaments, sensation, motor examination, and pulses were normal, but his range of motion was markedly limited by the tense effusion. Given the severity of the effusion and for both therapeutic and diagnostic purposes, the knee was aspirated. The aspirated joint fluid (100 cc) had the gross appearance of blood. It was sent for analysis, which revealed a white blood count of 6,000, a red blood count of 3.8 million and no crystals. Serum C-reactive protein and erythrocyte sedimentation rate levels were sent and were within normal limits. There was no evidence of infection in the culture of the joint's aspirate.

In the ensuing days, he had some temporary relief of his symptoms, but on postoperative day 14, he returned to the emergency department with a similar tense effusion. His erythrocyte sedimentation rate remained normal, but the effusion was quite painful. His knee was again aspirated (90 cc), again having the gross appearance of blood, a red blood count of 3.1 million and a white blood count of 500. His sensation, motor examination and pulses remained normal. After aspiration, he was much more comfortable. His knee was wrapped in a compressive dressing, and he was sent home. Within hours, the tense effusion reaccumulated, and he returned to the emergency department. Because of the severity of his pain and the tenseness of the effusion, the knee was aspirated and placed in a compressive dressing and an immobilizer and monitored overnight. The next morning his vital signs were stable; he was comfortable in the immobilizer and was sent home.

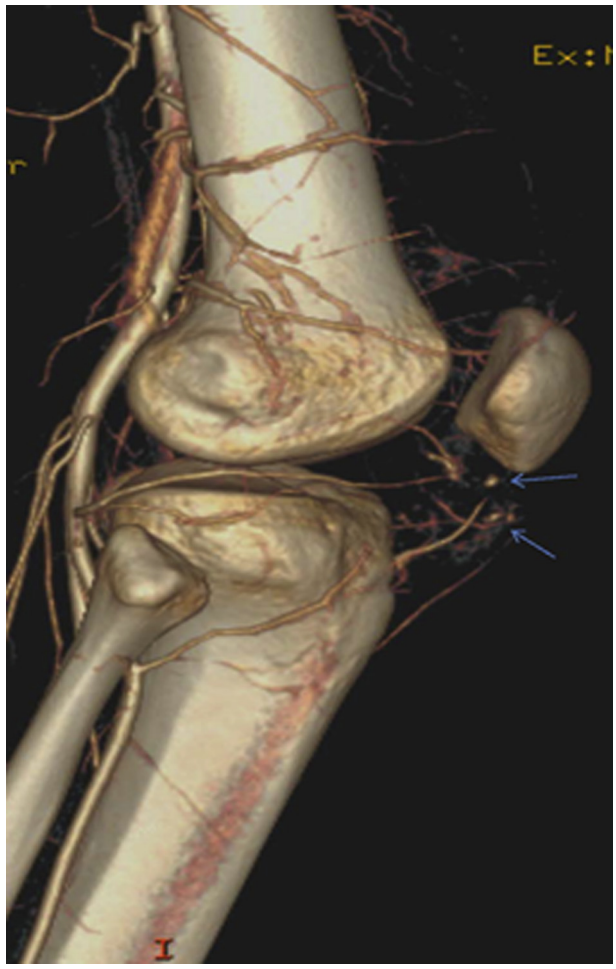

Fig 1. 3D volume-rendered maximum intensity projection (MIP) image of right knee CTA. Sagittal reconstruction with blue arrows indicating 2 anterior sites of contrast extravasation in the arterial phase corresponding to the location of the anterior portals.

The patient was seen on postoperative day 16 with continued pain and a tense effusion and was again admitted to the hospital. A differential diagnosis was developed that included coagulopathies, vascular abnormalities (pseudoaneurysm, arteriovenous malformation) or, potentially, an injury to a branch or branches of the medial or lateral geniculate artery. Our vascular surgery and hematology colleagues were consulted.

A CT angiogram (Figs 1-4) and a full coagulation profile were performed. CT scans were obtained using a 64-slice multidetector CT scanner (Optima CT660, GE Healthcare, Milwaukee, WI, USA) with the following standard acquisition protocol: pitch, 0.984; current, 180 mAs; voltage, 120 kVp; collimation, 64 × 0.625 mm;

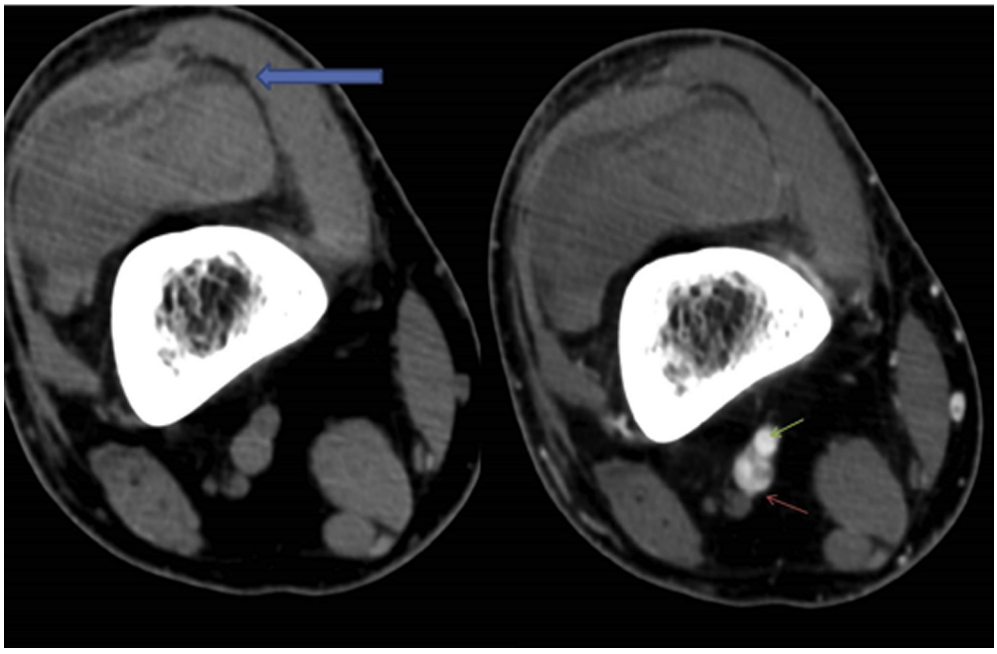

Fig. 2. Left: Axial noncontrast CT image of the supra patellar recess demonstrating a large joint effusion with layering hyperdense fluid consistent with a hemarthrosis. Solid blue arrow points to fluid-fluid level reflecting the hematocrit effect. Right: Axial post-contrast CT at the same location. Note the arterial phase of imaging confirmed by the identification of contrast within the popliteal artery (green arrow) and the mixing of contrast-enhanced and noncontrast blood within the larger popliteal vein (red arrow).

view at acquisition, 180 mm; slice thickness, 0.625 mm without section overlapping; and matrix size, 512 × 512. Images were reconstructed at 2.5 mm in standard and bone algorithms. Images were performed both before and after the intravenous administration of 100 mL Isovue 370 iodinated IV contrast material injected at a rate of 3 mL per second, followed by a saline flush. Contrast bolus tracking using a trigger threshold of 100 HU, with the region of interest placed in the upper abdominal aorta was used. 2D multiplanar reformations were performed in the sagittal and coronal plane. Additional postprocessing using an independent terarecon server was used to create maximum-intensity-projection and 3D volume-rendered images.

Early results of the coagulation profile showed normal Factors II, V, VII, IX, X, and XIII. The Factor VIII level, however, was low, at 15% of normal values. His erythrocyte sedimentation rate and serum C-reactive protein level remained within normal limits. A provisional diagnosis of hemophilia A was made, and the patient was treated with daily infusions of recombinant

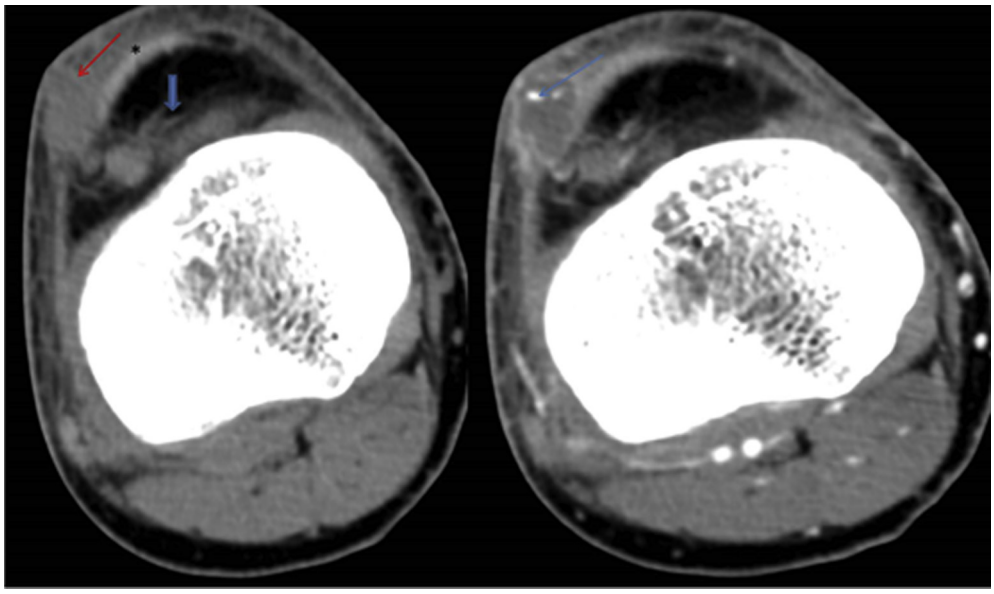

Fig 3. Left: Noncontrast axial CT image at the level of the patella tendon (*) demonstrates a small lateral parapatellar fluid collection at the site of the anterior lateral portal (red arrow). Right: Postcontrast arterial phase scan at the same level demonstrates a serpiginous and punctate focus of increased density (blue arrow), which is isodense to surrounding vessels and consistent with active contrast extravasation at the portal site. Focal increased attenuation and stranding within the Hoffa fat deep to the portal site (black arrow), consistent with hemorrhage along the portal tract.

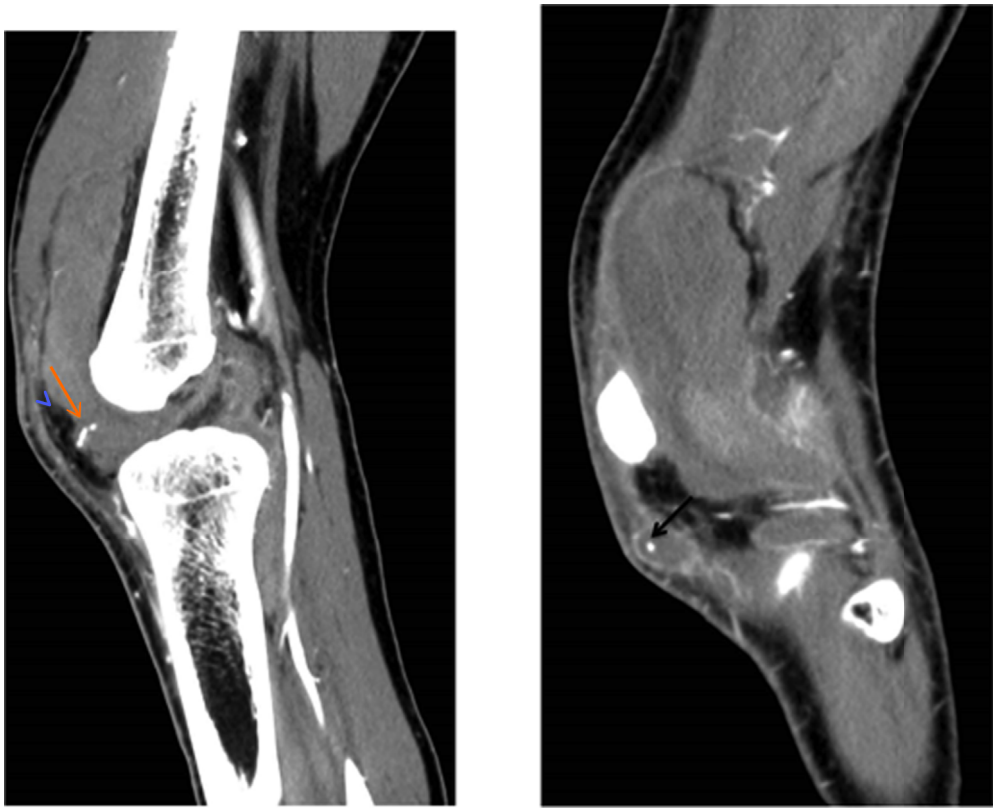

Fig. 4. Left: Sagittal arterial phase image from right knee CTA demonstrates hyperdense joint fluid secondary to hemarthrosis, as well as a linear hyperdensity (orange arrow) consistent with the site of active extravasation of contrast. Right: Sagittal arterial phase image from right knee CTA demonstrates hyperdense joint fluid secondary to hemarthrosis, as well as a punctate hyperdensity (black arrow) with a small surrounding fluid collection at the anterior lateral portal.

Factor VIII product at approximately 47 units/kg. After 3 days of daily infusions, a small effusion remained, and his clinical examination partially improved. The knee was aspirated again, and 40 cc of bloody aspirate (6.7 million red blood count, 8200 white blood count) were removed. Over the next 2 days, the tense effusion recurred and the patient was transferred to the inpatient pediatric unit for management by the Hemophilia Treatment Center of his hemarthrosis in the setting of mild hemophilia. New coagulation studies indicated a normal Von Willebrand factor, normal factor XI studies and a negative screen for factor VIII inhibitor. He was also found to have a positive lupus anticoagulant, which also likely contributed to his prolonged partial thromboplastin time.

On postoperative day 23, because of lack of complete clinical improvement, prednisone was added as an anti-inflammatory agent. In the ensuing days, his factor VIII levels began to increase. He was discharged home and continued on a course of Factor VIII infusions and prednisone, with close follow-up by both the orthopaedic surgery and pediatric hematology services. He initially remained in the knee immobilizer. He had no further episodes of recurrence of the effusion. At 6 weeks after surgery, he was able to walk without the aid of crutches. His range of motion was painless from 0 to 110 degrees. Eleven weeks after his surgery he had no pain, no effusion or soft-tissue swelling, full extension and flexion to 130° that was 5 degrees less than the contralateral normal side.

Discussion

Our case represents a unique presentation of a patient with a bleeding disorder following a routine knee arthroscopy, having had no prior history, personally or in his family. The case illustrates a cautionary presentation of an unusual disorder that should be in the differential for providers encountering recurrent postoperative hemarthrosis.

There is a paucity of discussion in the literature regarding the management of recurrent hemarthrosis following arthroscopy of the knee in patients with hemophilia, particularly among patients with previously undiagnosed clotting disorders. Those who have described arthroscopy in patients with diagnosed coagulopathies have noted that it should be reserved as a method of last resort, given the potential complications, which include recurrent hemarthrosis and subsequent joint contractures.[8,9]

Prompt recognition of a clotting abnormality is essential to prevent the dreaded complications of recurrent inflammation and synovitis in the setting of recurrent hemarthrosis, potentially resulting in arthrofibrosis and, ultimately, joint destruction.[7] To prevent

these complications, previous literature has supported the administration of clotting factors that were absent prior to surgical intervention.[3,7] Once present, treatment of hemarthrosis in a patient with hemophilia is difficult and should involve administration of the deficient clotting factors and immobilization of the joint.[7] Additionally, though it is controversial, there is some indication that arthroscopic debridement of knees with hemophiliac arthropathy may prevent or lessen joint destruction.[10]

More rare clotting disorders such as factor XIII deficiency present a unique challenge because they are not readily identifiable on standard hematologic laboratory tests.[9] These disorders require a high index of suspicion and represent a case in which there is significant benefit to involving the hematology service to aid in diagnosis and management.

Hemophilia is an important consideration in patients with unexplained hemarthrosis, but there are also other causes of recurrent hemarthrosis. These alternative diagnoses must be considered when developing a differential diagnosis for recurrent postoperative hemarthrosis. Historical references have indicated that pseudoaneurysms have been a source of recurrent hemarthrosis following arthroscopy, in particular, following lateral meniscectomy, given the proximity to the periarticular vasculature.[11,12] Additional reports have discussed the presence of arteriovenous fistulas as the cause of a recurrent postoperative hemarthrosis in a patient undergoing knee arthroscopy.[13] A case of recurrent meniscal hematoma has been described as a cause of recurrent hemarthrosis as well.[14] An additional case of intra-articular nodular fasciitis was also found to be responsible for recurrent hemarthrosis.[15] In the elderly population, specifically in patients with osteoarthritis, recurrent hemarthrosis has been seen in patients with torn lateral menisci.[16] Structural sources of bleeding must be considered in conjunction with coagulopathies. Imaging studies such as CT angiograms can be performed simultaneously with screening for coagulopathy in these patients.

Although many providers do routinely obtain preoperative testing, the routine use of preoperative blood testing is of questionable efficacy and cost-effectiveness.[17,18] Clotting disorders may be screened for when suspected, using a battery of common tests, including prothrombin time, APTT, bleeding time, and platelet count. Hemophilia may present with elevated APTT, but it is also possible for screening tests to be negative in those with mild disease.[4] The question remains: what is the best way to prevent postoperative complications resulting from previously undiagnosed clotting disorders in patients who do not report relevant family or personal history of clotting dysfunction? Postoperative vigilance, in combination with careful preoperative history taking, is likely a surgeon's best defense against these described complications, with early recognition and subsequent expedient involvement of hematology colleagues being of paramount importance.

Although recent studies have considered the utility of routine tranexamic acid as an adjunct treatment to help prevent hemarthrosis following knee arthroscopy or anterior cruciate ligament reconstructions, no literature discusses the efficacy of this treatment in patients with clotting disorders.[19,20] This may represent a future direction for potential prevention of this rare complication.

Conclusions

The incidence of previously undiagnosed hemophilia presenting as a cause for postoperative complications following knee arthroscopy is exceedingly rare. The authors feel that it is important to raise awareness of this scenario to prevent the morbidity resulting from a delay in diagnosis of a patient with this issue. Awareness of this potential presentation can save patients additional procedures and unnecessary tests when targeted screening and appropriate treatment are initiated expeditiously.

References

1. Friberger Pajalic K, Turkiewicz A, Englund M. Update on the risks of complications after knee arthroscopy. *BMC Musculoskelet Disord* 2018;19:179.
2. Small NC. Complications in arthroscopic surgery performed by experienced arthroscopists. *Arthroscopy* 1988;4:215-221.
3. Heim M, Israeli A, Varon D, et al. Expanding portal haematomata as a complication of knee arthroscopies in persons with haemophilia. *Haemophilia* 1999;5:213-215.
4. Srivastava A, Brewer AK, Mauser-Bunschoten EP, et al. Guidelines for the management of hemophilia. *Haemophilia* 2013;19:e1-e47.
5. Soucie JM, Evatt B, Jackson D. Occurrence of hemophilia in the United States: The Hemophilia Surveillance System Project Investigators. *Am J Hematol* 1998;59:288-294.
6. Majid Z, Tahir F, Qadar LT, Shaikh MY, Mahmood Shah SM. Hemophilia A with a rare presentation of hemarthrosis and arthropathy involving multiple joints in a young male child. *Cureus* 2019;11:e4524.
7. Rodriguez-Merchan EC. Aspects of current management: Orthopaedic surgery in haemophilia. *Haemophilia* 2012;18:8-16.
8. Kachooei AR, Badiei Z, Zandinezhad ME. Vicious cycle of multiple invasive treatments in a hemophilic inhibitor positive child with resistant knee flexion contracture, a case report. *Arch Bone Jt Surg* 2013;1:116-119.
9. Tsujii A, Tanaka Y, Yonetani Y, et al. Knee hemarthrosis after arthroscopic surgery in an athlete with low factor XIII activity. *Sports Med Arthrosc Rehabil Ther Technol* 2012;4:35.
10. Rodriguez-Merchan EC, Gomez-Cardero P. Arthroscopic knee debridement can delay total knee replacement in

painful moderate haemophilic arthropathy of the knee in adult patients. *Blood Coagul Fibrinolysis* 2016;27:645-647.
11. Fairbank T, Jamieson E. A complication of lateral meniscectomy. *J Bone Joint Surg Br* 1951;33:567-570.
12. Becher C, Burger UL, Allenberg JR, et al. Delayed diagnosis of a pseudoaneurysm with recurrent hemarthrosis of the knee joint. *Knee Surg Sports Traumatol Arthrosc* 2008;16:561-564.
13. Cohen B, Griffiths L, Dandy D. Arteriovenous fistula after arthroscopic synovectomy in a patient with haemophilia. *Arthroscopy* 1992;8:373-374.
14. Ochiai S, Hagino T, Watanabe Y, Senga S, Haro H. A rare case of meniscal hematoma with hemarthrosis of the knee: A case report. *J Bone Joint Surg Am* 2011;93:e104.
15. Matsuzaki T, Akisue T, Kishimoto K, et al. Intra-articular nodular fasciitis of the knee: A rare cause of recurrent hemarthrosis. *Rheumatol Int* 2012;32:1691-1694.
16. Sasho T, Ogino S, Tsuruoka H, et al. Spontaneous recurrent hemarthrosis of the knee in the elderly: Arthroscopic treatment and etiology. *Arthroscop* 2008;24:1027-1033.
17. Riggs KR, Bass EB, Segal JB. Role of patient- and surgery-specific risk in receipt of outpatient preoperative testing. *Perioper Care Oper Room Manag* 2018;10:18-26.
18. Johansson T, Fritsch G, Flamm M, et al. Effectiveness of non-cardiac preoperative testing in non-cardiac elective surgery: A systematic review. *Br J Anaesth* 2013;110:926-939.
19. Nugent M, May JH, Parker JD, et al. Does tranexamic acid reduce knee swelling and improve early function following arthroscopic meniscectomy? A double-blind randomized controlled trial. *Orthop J Sports Med* 2019;7:2325967119866122.
20. Chiang ER, Chen KH, Wang ST, et al. Intra-articular injection of tranexamic acid reduced postoperative hemarthrosis in arthroscopic anterior cruciate ligament reconstruction: A prospective randomized study. *Arthroscopy* 2019;35:2127-2132.