Total knee arthroplasty in a case of diffuse idiopathic skeletal hyperostosis; challenges in ligament balancing and deformity correction

Anoop Jhurani[1], Piyush Agarwal[1], Mukesh Aswal[1], Vishal Gupta[2]

Learning Point of the Article:

Diffuse idiopathic skeletal hyperostosis can present as a painful stiff knee and can limit final range of motion after total knee arthroplasty.

Abstract

Introduction: Diffuse skeletal idiopathic hyperostosis is a non-inflammatory systemic skeletal condition in which there is ossification of ligaments, tendons, and joint capsule. Although the radiological changes and clinical manifestation of diffuse idiopathic skeletal hyperostosis (DISH) in the spine have been well defined in the literature, the changes in the knee and their implications on knee replacement are unclear.

Case Report: A 60 year -year-old patient presented with pain, stiffness, and decreased arc of movement at the right knee. The X-rays showed ossification of the joint capsule, ligaments, and quadriceps expansion. The spine had has calcification of the anterior longitudinal ligament and '"wax drop' drop" enthesophytes. Based on the complete skeletal survey, a diagnosis of DISH was made. During knee arthroplasty, it was difficult to correct the deformity with a measured resection technique. Additional resection of 4 mm was done both from the distal femur and proximal tibia to correct the deformity and achieve optimal kinematics. This unpliable nature of the soft tissues due to enthesitis ossification of periarticular tissues led to decrease flexion postoperatively.

Conclusion: Surgeons should keep the diagnosis of DISH in mind when dealing with a stiff knee and be prepared for additional bone resection with extensive soft tissue release to balance the prosthetic knee joint.

Keywords: Computer navigation, Diffuse idiopathic Skeletal hyperostosis, Stiff knee, Total knee replacement.

Introduction

Diffuse idiopathic skeletal hyperostosis (DISH) or diffuse skeletal idiopathic hyperostosis is a non-inflammatory systemic skeletal condition in which there is ossification of ligaments, tendons, and joint capsule [1]. It is also known as Forestier disease or senile vertebral ankylosing hyperostosis and occurs more commonly in older males [2]. Changes are marked in the spine with calcification of the anterior longitudinal ligament and maintenance of disc space [3]. Although the radiological changes and clinical manifestation of DISH in the spine have been well defined in the literature [4], the changes in the knee and their implications on knee replacement are unclear. We present the challenges encountered during knee replacement in a case of DISH and an algorithm to balance and correct the deformity with computer navigation (Fig. 1).

Case Report

A 60 year -year-old ex-army man presented with painful arthritis of the knee and fixed flexion deformity of 5°. The range of motion of the affected knee was from 5 to -90°. There was significant calcification in the quadriceps expansion both in

Access this article online

Website: www.jocr.co.in

DOI: 2250-0685.1408

Author's Photo Gallery


Dr. Anoop Jhurani


Dr. Piyush Agarwal


Dr. Mukesh Aswal


Dr. Vishal Gupta

[1]Department of Orthopaedics, Joint Replacement Surgery Research Unit, Fortis Escorts Hospital, Jaipur, Rajasthan, India.
[2]Department of Anaesthesia, Fortis Escorts Hospital, Jaipur, Rajasthan, India.

Address of Correspondence:
Dr. Anoop Jhurani,
Director Joint Replacement Services, Fortis Escorts Hospital, JLN Marg, Malviya Nagar, Jaipur, Rajasthan, India.
E-mail: anoopjhurani@gmail.com

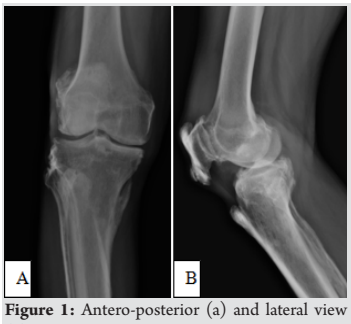

Figure 1: Antero-posterior (a) and lateral view (b) of the right knee showing enthesial spurs at the site of quadriceps expansion on the patella, ossification of collateral ligaments along with minimal tibiofemoral arthritis.

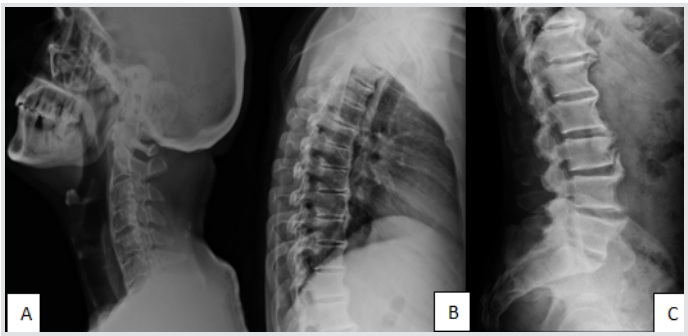

Figure 2: Lateral view of cervical and thoracic vertebra (a and b) showing flowing wax appearance of osteophytes. Lateral view lumbar-sacral spine (c) showing consecutive calcification of spinous ligaments with preservation of intervertebral disc height.

Figure 3: Antero-posterior view of pelvis with both hips showing pelvic whiskering, normal hip joint space, preserved sacroiliac joint, ossification of the labrum, and capsule.

supra and infrapatellar areas. There were unusual spike shaped enthesophytes in the quadriceps tendon (Fig. 1). The joint capsule and the medial collateral ligament also showed ossification. On further evaluation of his spine, there was classical ossification of the anterior longitudinal ligament of thoracic, cervical, and lumbar regions with the maintenance of joint space (Fig. 2). Pelvis skiagram showed ossification of the capsule with maintenance of joint space (Fig. 3). Sacroiliac and zygoapophyseal joints were not fused. Small joints of hand and feet also showed ossification in the ligaments and joint capsule (Fig. 4). Based on the criteria of Resnick and Niwayama [5, 6], a diagnosis of DISH was made. A differential of DISH with similar etiologies is detailed in [Table 1].

DISH is known to be associated with metabolic syndrome (hyperlipidemia, hypertension, and diabetes) though this particular patient did not have any metabolic association [7, 8]. DISH patients can have respiratory, upper esophageal and neurological manifestations because of due to compression from enthesophytes at cervical and upper dorsal regions [9]. This may lead to complications during or after anesthesia [10]. The patient in this report did not have any of the above complications before or after surgery as the procedure was done under regional epidural anesthesia.

Surgical Technique

All knee replacements in our unit are performed with image-free Ci navigation system (Brain Lab, Munich, Germany) with pins inserted inside the incision (Fig. 5). Femur The femur is prepared first and measured resection is done to accommodate the implants. Final soft tissue balancing is done at the end of the procedure based on objective data from the navigation. The aim is to correct the deformity in sagittal and coronal planes and achieve optimum patellar tracking. In this case, the knee remained in 20° flexion after measured resection. We then went back and resected 4 mm more of the distal femur, but still had a tight extension and flexion gaps (Fig. 6). This could be explained by ossification of the joint capsule and loss of elasticity of the soft tissue envelope around the knee. We finally had to resect 4 mm more of tibia to get to equal flexion and extension space (Fig. 6) and correction of sagittal deformity up to 5°o (Fig. 7). Resecting 4 more mm of bone from the femur and the tibia was an unusual and surprising phenomenon of this surgical reconstruction as deformity was not significant. Knee replacement was done by the cemented posterior stabilized system (Legion®, Smith and Nephew, Memphis [TN], USA). The coronal femoral angle was corrected from 86.4° to 90.1° and the coronal tibial angle corrected from 85° to 89.5° postoperatively (Fig. 8). The Hip-Knee-Ankle (HKA) angle improved from 170.5° to179.6° postoperatively (Fig. 9). His knee society score improved from 34 points to 85 points, postoperatively. The functional score improved from 19 points to 80 points. Joint line elevation can be seen in comparative pre-operative and post-operative X-rays. 75 mg indomethacin was given daily for 6 weeks as prophylaxis for heterotopic calcification [11]. At final follow follow-up of one 1year,the patient had 5 degree flexion deformity and up to 95° degree range of motion. Usually 5° flexion deformity resolves with rehabilitation, but in this case, it was resistant, which can be explained by the inability of soft tissues to stretch and accommodate to the prosthetic implants.

Figure 4: Anteroposterior (a) and oblique view (b) of foot showing Achillestendon spurs and ossification of capsule around intertarsal and metatarsophalangeal joints.

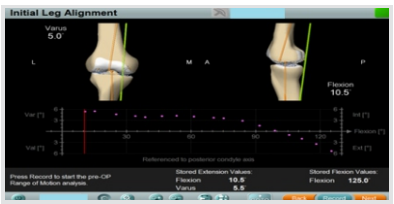

Figure 5: Intraoperative navigation image showing sagittal and coronal deformity. Purple dots represent kinematics of the knee along with range of movement.

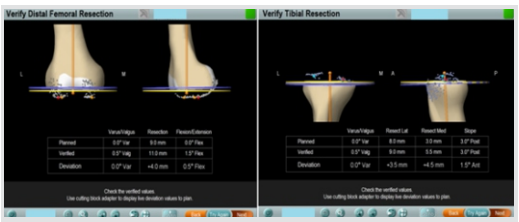

Figure 6: Intraoperative navigation image showing additional +4mm distal femur resection.

Figure 7: Intraoperative navigation image showing a final corrected kinematic graph.

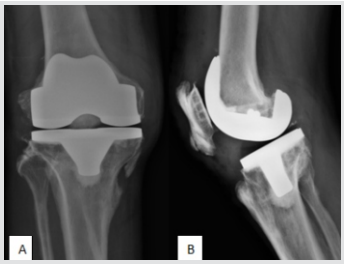

Figure 8: Post-operative anteroposterior (a) and lateral X-rays (b) of the knee.

Discussion

The main objective of this case report is to clearly delineate the clinical and radiological features of DISH at the knee joint and outline the principles and important steps to perform total knee arthroplasty (TKA) in case of DISH.

DISH at knee joint should be differentiated from other causes of the stiff knee like such as inflammatory arthropathy, heterotrophic ossification, and post-traumatic arthrosis (Fig. 10).

Inflammatory arthropathies have a female preponderance and are associated with synovial proliferation and regional osteopenia [12]. Upto 2 mm additional bone resection along with posterior soft tissue release usually corrects the flexion deformity associated with rheumatoid arthritis.

These features should be differentiated from post head injury, or post-burn heterotrophic ossification where these are periarticular bony bridges across the joint unlike DISH where their ossification is in the soft tissues [13].

In post-traumatic arthrosis, implants and associated fibrosis may be the cause of stiffness and navigation may help in by passing the implant and perform TKA without the need to remove the implants [14].

DISH can be differentiated from other causes of stiffness by calcification in the supra and infrapatellar part of quadriceps expansion. There is ossification along with the collateral ligaments and spurring at the tibial insertion of the patellar tendon.

Once the diagnosis of DISH is made at the knee, certain measures need to be followed to perform a successful TKA. DISH knee can be resistant to correction because of due to unyielding soft tissues. Upto 8 mm more bone, 4 mm each from femur and tibia may be required to be cut to achieve successful prosthetic implantation. This will elevate the joint line and cause patella baja and patellar maltracking [15]. In this case, the patellar button was superiorized and medialized to optimize patellar tracking. Moreover, a complete lateral release had to be performed because the ossification in quadriceps tendon and lateral retinaculum was causing lateral subluxation of the patella.

Apart from +4mm of distal femur resection, posterior capsule was completely elevated from the posterior aspect of the femur to increase the extension space. Furthermore, postero-medial capsule was cut in extension with a laminar spreader in the extension space. All these measures helped to achieve extension of the knee up to 5°. The final arc of movement as shown by navigation was 5–95° flexion. To improve the flexion of the knee pie crusting of quadriceps tendon was done but the flexion was resistant to improvement. After all the measures, the final arc remained 5–95°. Supervised rehabilitation was advice to the patient but at one 1 year follow follow-up, the arc of knee motion remained unchanged from 5 to -95°. This is unusual as 5° flexion deformity usually resolves with physiotherapy but did not in this case because of due to periarticular and ligamentous ossification.

Patient undergoing TKA for Diffuse Idiopathic Skeletal Hyperostosis should be prognosticated regarding possibility of decreased range of motion postoperatively as the soft tissue envelope loses its elasticity and ability to stretch because of enthesetic ossification.

Figure 9: Pre-operative (a) and post-operative (b) full length antero-posterior X-ray of lower limb showing restoration of hip-knee-ankle axis.

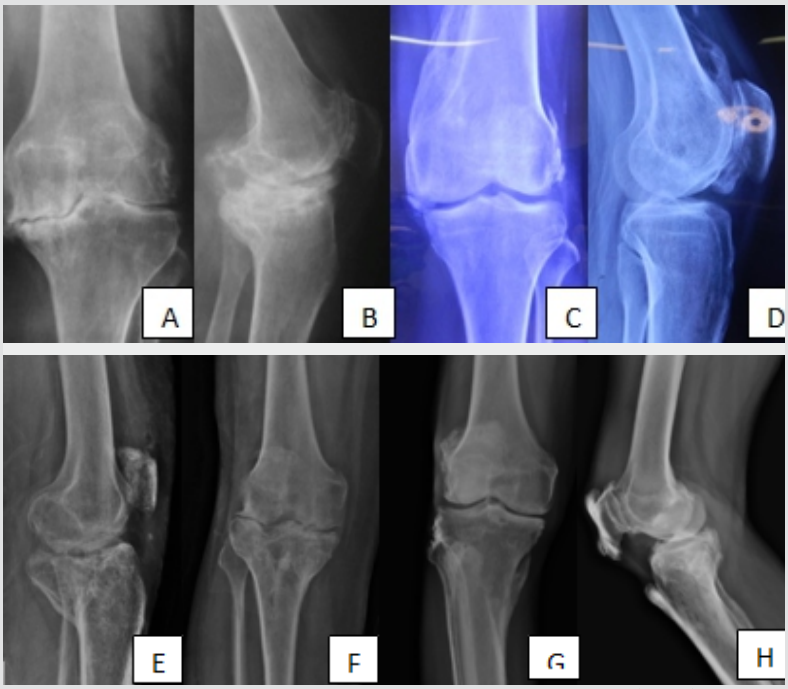

Figure 10: Anteroposterior and lateral view of knees showing differentiation of stiff knee (a and b) rheumatoid arthritis, (c and d) heterotrophic ossification, (e and f) post-traumatic arthritis, and (g and h) diffuse idiopathic skeletal hyperostosis.

Table 1: Differentiating features of ankylosing spondylitis, DISH, and osteoarthritis

S. No	Differentiating feature	Ankylosing spondylitis	Osteoarthritis	DISH
Demographic				
1	Age of onset	Younger <40year	Older <60year	Older >60year
2	Sex	M>F	M=F	M>F
3	Prevalence	0.1–0.87%	0.85–3.8%	2.9–27.3%
4	Primary anatomic site of involvement	Spine	Knee/hip	Spine
5	Presenting symptoms	Backache, stiffness, pain	Pain on activity decreased activity	Usually asymptomatic or mild stiffness
Investigations				
6	Diagnostic X-ray view	Antero-posterior spine view	Local X-ray	Lateral spine view
7	HLA B27	Positive	Negative	Negative
Spine manifestation				
8	Intervertebral disc height	Decreased	Rarely decreased	Preserved
9	Zygapophyseal joints	Involved	Rare	Preserved
10	Spinous ligamentous ossification	PLL[a]>ALL[b]	Rare	ALL>PLL
11	Dorsal kyphosis	Very frequent	Rare	Frequent
12	Spinal mobility limitation	Moderate to severely decreased	Normal	Mild to moderate decrement
Extra-spinal manifestations				
13	Intra-articular ankylosis	Common	Rare	Rare
14	Extra-articular manifestation	Systemic involvement common such asuveitis, bowel disease	Systemic involvement absent	Systemic involvement absent
15	Sacroiliac joint erosion	Very common	Rare	Absent
16	Sacroiliac joint obliteration	Very common bothligamentous and synovial	Rare	Rare but if occurs, it is ligamentous
17	Enthesopathies (whiskering)	Commonly present with erosions	Absent	Commonly present without erosions
18	Involvement of joints such as shoulder, elbow, and metacarpophalangeal joints	Rare	Rare	Common
19	Signs of progressive disease in knee and other joints.	Pain, deceased ROM[c], hunchback posture, flexion deformity and possible fibrous ankylosis	Pain, increased coronal deformity, decreased joint space	Stiffness, flexion deformity, decreased ROM and joint space is maintained
20	Chest expansion	Decreased	Normal	Normal

*PLL[a]: Posterior longitudinal ligament, ALL[b]: Anterior longitudinal ligament, ROM[c]: Range of movement, DISH: Diffuse idiopathic skeletal hyperostosis

While performing knee replacement for DISH cautious prognostication should be done to the patient regarding possibility of decreased flexion after arthroplasty as the soft tissue envelope loses its elasticity and ability to stretch because of enthesetic ossification.

Current controversies and future considerations: Little is known about the etio-pathogenesis, genetic basis, therapeutic approach, progression of spinal, and extra-spinal manifestation of DISH. Furthermore, the classification system tends to classify the disease at a later stage, hence making it difficult for any therapeutic modality to influence the progression of the disease. Current efforts and researches are directed towards finding a genetic link to DISH, developing a new classification to identify the patients at an early stage and development of novel targeted therapies.

Conclusion

DISH at the knee is likely to present with stiffness due to ossification of ligaments and the joint capsule. While performing TKA, more bone resection will be required both from the femur and tibia as the soft tissues have limited ability to stretch and accommodate the implants. The aim should be to fully correct the fixed flexion deformity during surgery as calcified soft tissue provides a minimal window for correction with rehabilitation.

Clinical Message

Suspect DISH in a case presenting with stiff knee and enthesophytes along with quadriceps tendon calcification.

Extensive soft tissue release and additional bone resection may be required from both femur and tibia to achieve extension. The patient should be counseled regarding the limited range of motion after TKA due to unpliable nature of soft tissue envelope.

References

1. Nascimento FA, Gatto LA, Lages RO, Neto HM, Demartini Z, Koppe GL, et al. Diffuse idiopathic skeletal hyperostosis: A review. Surg Neurol Int 2014;16 5 Suppl 3:S122-5.
2. Vaishya R, Vijay V, Nwagbara IC, Agarwal AK. Diffuse idiopathic skeletal hyperostosis (DISH): A common but less known cause of back pain. J Clin Orthop Trauma2017;8:191-6.
3. Baxi V, Gaiwal S. Diffuse idiopathic skeletal hyperostosis of cervical spine an unusual cause of difficult flexible fiber optic intubation. Saudi J Anaesth 2010;4:17-9.
4. Mader R, Sarzi-Puttini P, Atzeni F, Olivieri I, Pappone N, Verlaan JJ, et al. Extraspinal manifestations of diffuse idiopathic skeletal hyperostosis.Rheumatology (Oxford)2009;48:1478-81.
5. Resnick D, Niwayama G. Radiographic and pathologic features of spinal involvement in diffuse idiopathic skeletal hyperostosis (DISH). Radiology 1976;119:559-68.
6. Resnick D, Niwayama G. Diagnosis of Bone and Joint Disorders. 2nd ed. Philadelphia, PA: WB Saunders; 1988. p. 1563-615.
7. Vezyroglou G, Mitropoulos A, Antoniadis C. A metabolic syndrome in diffuse idiopathic skeletal hyperostosis. A controlled study. J Rheumatol 1996;23:672-6.
8. Pillai S, Littlejohn G. Metabolic factors in diffuse idiopathic skeletal hyperostosis a review of clinical data. Open Rheumatol J 2014;8:116-28.
9. Pulcherio JO, Velasco CM, Machado RS, Souza WN, Menezes DR. Forestier's disease and its implications in otolaryngology: Literature review. Braz J Otorhinolaryngol2014;80:161-6.
10. Paley D, Schwartz M, Cooper P, Harris WR, Levine AM. Fractures of the spine in diffuse idiopathic skeletal hyperostosis. Clin Orthop Relat Res1991;267:22-32.
11. Jeffrey PC, Salvati EA, Sculco TP. Indomethacin for the prevention of heterotopic ossification following total hip arthroplasty. J Arthroplast 1988;3:229-34.
12. Goldring SR, Gravallese EM. Mechanisms of bone loss in inflammatory arthritis: Diagnosis and therapeutic implications. Arthritis Res 2000;2:33-7.
13. Rollo G, Pellegrino M, Filipponi M, Falzarano G, Medici A, Meccariello L, et al. A case of the management of heterotopic ossification as the result of acetabular fracture in a patient with traumatic brain injury. Int J Surg Open 2015;1:30-4.
14. Panni AS, Cerciello S, Vasso M, Tartarone M. Stiffness in total knee arthroplasty. J Orthop Traumatol 2009;10:111-8.
15. Kumar N, Mukhopadhaya J, Yadav C, Anand S, Singh S. Joint line restoration in total knee arthroplasty. J Orthop Allied Sci 2017;5:10-4.

Conflict of Interest: Nil
Source of Support: Nil

Consent: The authors confirm that Informed consent of the patient is taken for publication of this case report

How to Cite this Article

Jhurani A, Agarwal P, Aswal M, Gupta V. Total knee arthroplasty in a case of diffuse idiopathic skeletal hyperostosis; challenges in ligament balancing and deformity correction. Journal of Orthopaedic Case Reports 2019 May-June; 9(3): 34-38.