

World Journal of *Orthopedics*

World J Orthop 2023 December 18; 14(12): 843-896



ORIGINAL ARTICLE**Retrospective Study**

- 843 Role of lateral soft tissues release in percutaneous hallux valgus correction: A medium term retrospective study

Zanchini F, Catani O, Sergio F, Boemio A, Sieczak A, Piscopo D, Risitano S, Colò G, Fusini F

Observational Study

- 853 Comparison of clinical outcomes between total hip replacement and total knee replacement

Green A, Walsh A, Al-Dadah O

- 868 Importance of computed tomography in posterior malleolar fractures: Added information to preoperative X-ray studies

De Marchi Neto N, Nesello PFT, Bergamasco JM, Costa MT, Christian RW, Severino NR

Randomized Controlled Trial

- 878 Efficacy and safety of thermobalancing therapy with Dr Allen's Device for chronic low back pain: A randomised controlled trial

Allen S, Rashid A, Adjani A, Akram M, Khan FS, Sherwani R, Khalil MT

CASE REPORT

- 889 Unicompartimental knee arthroplasty metallosis treated with uni-on-uni revision: A case report

Toro G, Braile A, Conza G, De Cicco A, Abu Mukh A, Placella G, Salini V

ABOUT COVER

Editorial Board Member of *World Journal of Orthopedics*, Ashim Gupta, MS, PhD, Founder and CEO, Orthopaedics and Regenerative Medicine, Future Biologics, Lawrenceville, GA 30043, United States. ashim6786@gmail.com

AIMS AND SCOPE

The primary aim of *World Journal of Orthopedics* (*WJO*, *World J Orthop*) is to provide scholars and readers from various fields of orthopedics with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJO mainly publishes articles reporting research results and findings obtained in the field of orthopedics and covering a wide range of topics including arthroscopy, bone trauma, bone tumors, hand and foot surgery, joint surgery, orthopedic trauma, osteoarthropathy, osteoporosis, pediatric orthopedics, spinal diseases, spine surgery, and sports medicine.

INDEXING/ABSTRACTING

WJO is now abstracted and indexed in PubMed, PubMed Central, Emerging Sources Citation Index (Web of Science), Scopus, Reference Citation Analysis, China Science and Technology Journal Database, and Superstar Journals Database. The 2023 Edition of Journal Citation Reports® cites the 2022 impact factor (IF) for *WJO* as 1.9. The *WJO*'s CiteScore for 2022 is 2.6.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: Zi-Hang Xu, Production Department Director: Xu Guo, Editorial Office Director: Jin-Lei Wang.

NAME OF JOURNAL

World Journal of Orthopedics

ISSN

ISSN 2218-5836 (online)

LAUNCH DATE

November 18, 2010

FREQUENCY

Monthly

EDITORS-IN-CHIEF

Massimiliano Leigheb, Xiao-Jian Ye

EXECUTIVE ASSOCIATE EDITORS-IN-CHIEF

Xin Gu

EDITORIAL BOARD MEMBERS

<http://www.wjgnet.com/2218-5836/editorialboard.htm>

PUBLICATION DATE

December 18, 2023

COPYRIGHT

© 2023 Baishideng Publishing Group Inc

PUBLISHING PARTNER

The Minimally Invasive Spine Surgery Research Center Of Shanghai Jiaotong University

INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjgnet.com/bpg/gerinfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/gerinfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

POLICY OF CO-AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/310>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/gerinfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>

PUBLISHING PARTNER'S OFFICIAL WEBSITE

https://www.shtrhospital.com/zkjs/info_29.aspx?itemid=647



Unicompartmental knee arthroplasty metallosis treated with uni-on-uni revision: A case report

Giuseppe Toro, Adriano Braile, Gianluca Conza, Annalisa De Cicco, Assala Abu Mukh, Giacomo Placella, Vincenzo Salini

Specialty type: Orthopedics

Provenance and peer review:

Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0

Grade B (Very good): 0

Grade C (Good): 0

Grade D (Fair): 0

Grade E (Poor): 0

P-Reviewer: OOMMEN AT, India

Received: August 29, 2023

Peer-review started: August 29, 2023

First decision: October 9, 2023

Revised: October 15, 2023

Accepted: November 9, 2023

Article in press: November 9, 2023

Published online: December 18, 2023



Giuseppe Toro, Adriano Braile, Gianluca Conza, Annalisa De Cicco, Department of Medical and Surgical Specialties and Dentistry, University of Campania “Luigi Vanvitelli”, Naples 80138, Italy

Assala Abu Mukh, Giacomo Placella, Vincenzo Salini, Department of Orthopaedics and Traumatology, San Raffaele Hospital, Milan 20132, Italy

Corresponding author: Giuseppe Toro, MD, PhD, Research Assistant Professor, Department of Medical and Surgical Specialties and Dentistry, University of Campania “Luigi Vanvitelli,” No. 4 Via L. De Crecchio, Naples 80138, Italy. giuseppe.toro@unicampania.it

Abstract

BACKGROUND

Metallosis is the result of metallic wear debris in the soft tissues and is associated to both local and systemic inflammatory response. Metallosis has been reported after total hip and total knee arthroplasty (TKA), but rarely after a unicompartmental knee arthroplasty (UKA). In the context of UKA metallosis, surgeons often opt for revision using a TKA. However, in this paper, the authors successfully treated UKA revising the metal back only.

CASE SUMMARY

Prior to treat our patient we conducted a literature research through which we identified eleven cases of metallosis after UKA, ten (90.9%) were treated revising using though a TKA. Only one case was managed through a uni-on-uni revision, reporting high knee function. Our patient complained worsening pain and function after a snap occurred at 16 mo after UKA implantation. At 18 mo following surgical debridement and uni-on-uni revision surgery, our patient exhibited a relevant improvement in Oxford Knee Score and a reduction of metal ion levels in the blood.

CONCLUSION

Our study highlights that in case of metallosis after UKA, the treatment may be based on surgical debridement and just revising the mobilized components.

Key Words: Metallosis; Unicompartmental knee arthroplasty; Revision; Uni-on-uni revision; case report; Review; Case report

Core Tip: Metallosis is a rare but serious complication of unicompartmental knee arthroplasty. It is generally treated through surgical debridement and revision to a total knee arthroplasty. However, in case of absence of critical signs of implant malpositioning, soft tissue impairment or bone loss, it could be successfully resolved through surgical debridement and uni-on-uni revision.

Citation: Toro G, Braile A, Conza G, De Cicco A, Abu Mukh A, Placella G, Salini V. Unicompartmental knee arthroplasty metallosis treated with uni-on-uni revision: A case report. *World J Orthop* 2023; 14(12): 889-896

URL: <https://www.wjgnet.com/2218-5836/full/v14/i12/889.htm>

DOI: <https://dx.doi.org/10.5312/wjo.v14.i12.889>

INTRODUCTION

Metallosis is a condition in which prosthetic metallic wear produces debris that could be observed in soft tissues, causing both local and systemic inflammation, and could be associated to malignant tumors and systemic toxicity[1,2]. Metallosis had been associated mainly with total hip arthroplasty (THA)[3]. In fact, it could be observed in 2%-5% of metal-on-metal THA implants, yet it was also described in the context of total knee arthroplasty (TKA) and less frequently unicompartmental knee arthroplasty (UKA)[4]. Metallosis treatment contemplates wide surgical debridement and revision surgery. Nevertheless, the authors noticed that the revision seems to differ from the damage entity. The rare cases of metallosis after an UKA are generally treated through a revision with TKA[5-15]. In this article, we review the literature and introduce a case of 77 years old man presenting an UKA metallosis treated with debridement and UKA tibial metalback revision.

CASE PRESENTATION

Chief complaints

This article reports the case of a 77 years old patient with a metallosis after a UKA.

History of present illness

13-mo before, the patient perceived a “snap”, that was initially conservatively treated, considering the complete and painless range of motion documented during outpatient evaluation.

History of past illness

Sixteen months prior to the metallosis diagnosis, the patient underwent to a medial UKA for unicompartmental knee osteoarthritis.

Personal and family history

The patient had no other relevant co-morbidities.

Physical examination

In the three months after the “snap,” the patient started to report a constant worsening of knee pain and a substantial reduction of joint function [oxford knee score (OKS) of 27/48].

Laboratory examinations

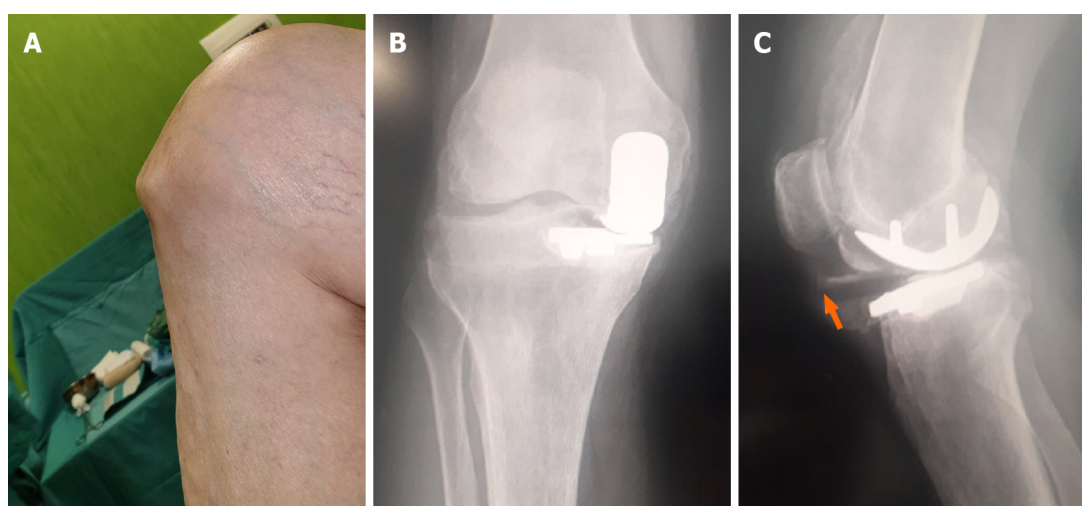
Baseline blood ion levels were in line with a diagnosis of metallosis (Chrome 1.26 µg/L, Cobalt 3.94 µg/L).

Imaging examinations

The imaging performed at that time confirmed tibial implant loosening (Figure 1) and revision surgery was necessary after excluding infection[16-18].

Multidisciplinary expert consultation

Prior to treat the patient, the research team decided to evaluate all the possible procedures. Therefore, a literature research was conducted through PubMed by two independent reviewers (Braile A and Conza G) using the following terms in their various combinations “Unicompartmental knee arthroplasty,” “metallosis,” “liner dislocation”, “fixed-bearing”, “mobile-bearing”. Studies compatible with our criteria were included and controversies between the two reviewers were analyzed by a third author for the inclusion decision (Salini V).



DOI: 10.5312/wjo.v14.i12.889 Copyright ©The Author(s) 2023.

Figure 1 Patient's preoperative evaluation. A: Clinics; B: Radiographs; C: Liner dislocation is indicated with white arrow.

The literature search was conducted only in PubMed given that 90% of high-quality studies can be retrieved from this database, as reported by Rollin *et al*[19]. Therefore, to summarize the knowledge around a specific topic, PubMed research should be considered cost-effective as practitioners are able to easily retrieve most of the literature by using it[19, 20]. All articles on metallosis after UKA in English, Spanish and Italian languages were included and analyzed in the present review. Articles with incomplete follow-up were excluded. The references cited in the included articles were also reviewed to identify further relevant studies. Data from each retrieved study were collected using a pre-arranged form. Out of 45 records identified, 20 presented criteria for further review. Eleven articles were then excluded after abstract review because did not meet the inclusion criteria. One further article was included after reviewing references cited in the included articles. Therefore, 10 articles, including 11 patients were retrieved and analyzed in the present study (Figure 2).

Patient age averaged 66.4 years (54-76 years), metallosis occurred at a mean time of 42.58 mo from the UKA. Out of 11 patients, 9 (81.8%) were treated through revision TKA. Two cases necessitated a second revision TKA at a mean of 39 mo. The functional outcome improved in all eleven cases (Table 1).

FINAL DIAGNOSIS

Intraoperatively, signs of soft tissue metallosis were evident (Figure 3). Following soft-tissue debridement and specimen collection, a component stability test confirmed isolated loosening of the tibial implant. Surgical specimen and baseline blood ion levels confirmed metallosis (Chrome 1.26 µg/L, Cobalt 3.94 µg/L).

TREATMENT

The mobilized tibial component was revised using a larger Genus UNI Alderortho implant (Cormano, Italy).

OUTCOME AND FOLLOW-UP

We assessed the patient functional status through OKS and blood ion levels as previously recommended[21,22]. The patient presented a normal postoperative course. Complete range of motion, OKS score improvement (40/48), and good knee alignment were reported at 18 mo (Figure 4), while normalization of Ion blood levels (Chrome 0.95 µg/L, Cobalt 1.06 µg/L) were documented at 30 d after the uni-on-uni revision (Table 2).

DISCUSSION

Although UKA is an effective bone-preserving surgical option for unicompartmental symptomatic knee osteoarthritis in young and middle-aged patients[23], several complications may arise after its implantation. Due to the increasing number of arthroplasties performed yearly, optimizing the complication management is necessary.

In our case, we attributed metallosis and implant failure due to the progressive subclinical spinout of the polyethylene liner in an undersized tibial component which led to a posterior overload on the tibial implant. The surgeons performed

Table 1 Literature review

| Article info | | | | Studied population | | | | | | | | | | Outcomes | | | | | | |
|--------------|----------------------------------|------|-------------------------------------|--------------------|-----------------|----------|-------------|-------------------|---|--------------------|-------------------|----------------------------|-----------------|-----------------------------------|----------------------------|-------------------------|-----------------------|-----------|----------|---------------------------------|
| N. | Ref. | Year | Journal | Type | Population (n.) | Sex | Age (yr) | Implant type | Months elapsed between implantation and bearing dislocation | Metal ions (Cr/Cb) | Type of procedure | Function pre-op | Knee ROM pre-op | Metal ions (Cr/Cb) last follow-up | Function last follow-up | Knee ROM last follow-up | General complications | Infection | Fracture | Implant loosening (yes /months) |
| 1 | Sanchis-Alfonso <i>et al</i> [5] | 2007 | KSSTA | Case report | 1 | M | 54 | Fixed bearing | | NA | Revision with TKA | | | NA | | | | | | |
| 2 | Apostolopoulos <i>et al</i> [6] | 2014 | <i>J Long Term Eff Med Implants</i> | Case report | 1 | M | 67 | Mobile bearing | 54 | NA | | | | NA | | | None | No | No | Yes /54 |
| 3 | Vecchini <i>et al</i> [10] | 2019 | <i>Acta Biomed</i> | Case report | 1 | M | 71 | NA | | NA | Revision with TKA | | 10-110 | NA | | 0-130 | None | No | No | |
| 4 | Greco <i>et al</i> [11] | 2018 | <i>The knee</i> | Case report | 1 | M | 72 | Fixed bearing | | NA | Revision with TKA | | | NA | | | None | No | No | |
| 5 | Rajgopal <i>et al</i> [13] | 2018 | <i>Arthroplast today</i> | Case report | 1 | M | 58 | NA | 24 | NA | Revision with TKA | KSS 48 OKS 19 UCLA 3 | 0-100 | NA | KSS 82 OKS 40 UCLA 7 | | None | No | No | Yes /24 |
| 6 | Vajapey <i>et al</i> [8] | 2021 | <i>Arthroplasty</i> | Case series | 2 | F | 76 | NA | 60 | NA | Revision with TKA | | 30-120 | NA | | | None | No | No | |
| 7 | Kiran <i>et al</i> [14] | 2021 | <i>JBJS Case connector</i> | Case report | 1 | M | 61 | Fixed bearing | 60 | NA | Revision with TKA | | NA | NA | OKS 39 | | None | None | None | |
| 8 | Foran <i>et al</i> [9] | 2013 | <i>Clin Orthop Relat Res</i> | Case series | 1 | NA | NA | NA | 56 | NA | Revision with TKA | | | NA | | | | | | |
| 9 | Luyet <i>et al</i> [12] | 2015 | <i>Acta Ortop. Belg.</i> | Case report | 1 | F | 67 | NA | 1,5 | NA | Revision with UKA | ksk 59 KSF 60 | 0-90 | NA | Ksk 87 KSF 90 | 0-110 | | No | No | |
| 10 | Pescador <i>et al</i> [15] | 2016 | <i>Reumatol Clin.</i> | Case report | 1 | F | 72 | NA | | NA | Revision with TKA | | | NA | | | | | | |
| TOT. | | | | | 11 | 6 M /4 F | Mean: 66, 4 | 3 Fixed /1 Mobile | Mean: 42, 58 | | 9 TKA /1 UKA | | | | | | | | | |

NA: Not available; TKA: Total knee arthroplasty; UKA: Unicompartmental knee arthroplasty; KSS: Knee society score; UCLA: UCLA activity scale; OKS: Oxford knee score; KSF: Knee society function score.

Table 2 Illustrating oxford knee score and blood ion levels before and after revision surgery

| | Pre-revision | Last follow-up |
|---------------|--------------|----------------|
| OKS | 27 | 40 |
| Chrome (µg/L) | 126 | 106 |
| Cobalt (µg/L) | 334 | 95 |

OKS: Oxford knee score.



DOI: 10.5312/wjo.v14.i12.889 Copyright ©The Author(s) 2023.

Figure 2 Summary of article inclusion process.

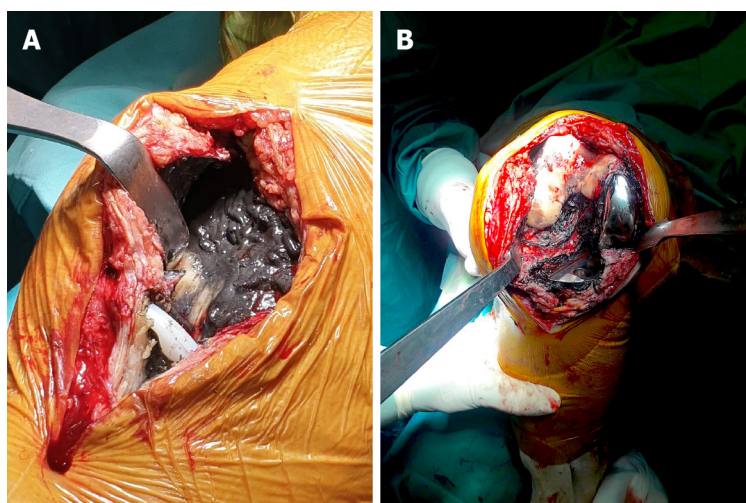
UKA revision with a new UKA larger tibial implant against general recommendations because no tibial slope or coronal malalignment were present[24-27].

Very few cases of UKA revision with a new UKA implant were described in the available literature. Luyet *et al*[12] in a case of anterior dislocation of the polyethylene liner at 6 wk, presenting as a painful and swollen knee[13] furtherly complicated by metallosis decided to treat it through a uni-on-uni revision. Following the surgery, the patient presented good clinical and radiological outcomes in a 2 year follow-up[12]. Good clinical outcomes were reported after a Uni-on-uni revision also in an another a recent review about metallosis after knee replacement[4]. Epinette *et al*[27] in a retrospective study of 36 UKA-to-UKA revision surgery described this treatment as a reliable option, with lower morbidity and better functional outcomes compared with UKA-to-TKA revision. The authors suggested to reserve in patients with limited bone defects and no extension of the lesions[27].

Our review is limited by several factors including low patient number, the absence of a statistical analysis related to the nature of the review, and lack of literature on UKA metallosis. However, to the best of our knowledge, this is the first study reporting bloodstream ion changes while confirming clinical improvement following uni-on-uni revision in case of UKA metallosis. However, we believe that further analysis is necessary to confirm successful uni-on-uni revisions in case of metallosis.

CONCLUSION

In conclusion, we suggest that aseptic UKA metallosis without critical signs of malpositioning, soft tissue impairment or bone loss could be treated with surgical debridement and unicompartmental knee revision arthroplasty. This kind of approach could lead to a significant improvement of functional outcomes, and blood ion levels.



DOI: 10.5312/wjo.v14.i12.889 Copyright ©The Author(s) 2023.

Figure 3 Intraoperative photographs documenting peri-prosthetic soft tissue metallosis. A: Note the luxated bearing; B: Note the metal back debris.



DOI: 10.5312/wjo.v14.i12.889 Copyright ©The Author(s) 2023.

Figure 4 Postoperative history. A and B: Postoperative X-rays; C-E: Clinical evaluation documenting range of motion at final follow-up; F and G: Radiographies documenting implant alignment at final follow-up.

FOOTNOTES

Author contributions: Braile A, Conza G and Salini V performed material preparation and data collection; Placella G, Toro G, Salini V performed data analysis and interpretation; Abu Mukh A and De Cicco A written the first draft of the manuscript; Placella G and Toro G revised the paper and wrote the final version of the manuscript; Toro G and Salini V supervised the entire study; all authors commented on previous versions of the manuscript; all authors read and approved the final manuscript; all authors contributed to the study conception and design.

Informed consent statement: Informed written consent was obtained from the patient for publication of this report and any accompanying images.

Conflict-of-interest statement: The authors declare that they have no conflict of interest.

CARE Checklist (2016) statement: The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

Country/Territory of origin: Italy

ORCID number: Giuseppe Toro 0000-0002-8560-721X; Adriano Braile 0000-0001-5366-5733; Gianluca Conza 0009-0003-7621-4013; Annalisa De Cicco 0000-0003-0548-5767; Giacomo Placella 0000-0002-7101-0404; Vincenzo Salini 0000-0002-8166-3062.

S-Editor: Qu XL

L-Editor: A

P-Editor: Yuan YY

REFERENCES

1. Toro G, De Cicco A, Braile A, Landi G, Schiavone Panni A. New insights on metal allergy in total joint arthroplasty. *J Biol Regul Homeost Agents* 2020; **34**: 125-130. IORS Special Issue on Orthopedics [PMID: 33739017]
2. Pesce V, Maccagnano G, Vicenti G, Notarnicola A, Lovreglio P, Soleo L, Pantalone A, Salini V, Moretti B. First case report of vanadium metallosis after ceramic-on-ceramic total hip arthroplasty. *J Biol Regul Homeost Agents* 2013; **27**: 1063-1068 [PMID: 24382188]
3. Goderecci R, Fidanza A, Necozone S, Francione V, Indelli PF, Calvisi V. Ultrasound-based decision making following metal-on-metal hip arthroplasty. *J Clin Orthop Trauma* 2020; **11**: 79-84 [PMID: 32001990 DOI: 10.1016/j.jcot.2019.04.009]
4. Sahani I, Anagnostakos K. Metallosis after knee replacement: a review. *Arch Orthop Trauma Surg* 2020; **140**: 1791-1808 [PMID: 32715399 DOI: 10.1007/s00402-020-03560-x]
5. Sanchis-Alfonso V. Severe metallosis after unicompartmental knee arthroplasty. *Knee Surg Sports Traumatol Arthrosc* 2007; **15**: 361-364 [PMID: 17028866 DOI: 10.1007/s00167-006-0207-6]
6. Apostolopoulos AP, Katsougrakis I, Fanous R, Harrison A, Saavedra E. Severe metallosis following polyethylene dislocation in a mobile-bearing medial unicompartmental knee replacement. *J Long Term Eff Med Implants* 2014; **24**: 147-150 [PMID: 25272213 DOI: 10.1615/jlongtermeffmedimplants.2014010563]
7. Fujii T, Matsui Y, Noboru M, Inagaki Y, Kadoya Y, Tanaka Y. Meniscal Bearing Dislocation of Unicompartmental Knee Arthroplasty with Faint Symptom. *Case Rep Orthop* 2015; **2015**: 217842 [PMID: 26137336 DOI: 10.1155/2015/217842]
8. Vajapey SP, Alvarez PM, Chonko D. Bearing failure in a mobile bearing unicompartmental knee arthroplasty: an uncommon presentation of an implant-specific complication. *Arthroplasty* 2021; **3**: 16 [PMID: 35236477 DOI: 10.1186/s42836-021-00073-9]
9. Foran JR, Brown NM, Della Valle CJ, Berger RA, Galante JO. Long-term survivorship and failure modes of unicompartmental knee arthroplasty. *Clin Orthop Relat Res* 2013; **471**: 102-108 [PMID: 22895691 DOI: 10.1007/s11999-012-2517-y]
10. Vecchini E, Ditta A, Gelmini M, Maluta T, Valentini R, Ricci M, Magnan B. Rupture of the femoral component and severe metallosis of the knee 10 years after unicompartmental knee arthroplasty (UKA): a case report. *Acta Biomed* 2019; **90**: 198-202 [PMID: 30715025 DOI: 10.23750/abm.v90i1-S.8082]
11. Greco N, Berend K. Polyethylene liner dislocation of fixed-bearing medial oxinium unicompartmental arthroplasty with severe metallosis. *Knee* 2018; **25**: 341-345 [PMID: 29525546 DOI: 10.1016/j.knee.2018.01.004]
12. Luyet A, Fischer JF, Jolles BM, Lunebourg A. Unexpected wear of an unicompartmental knee arthroplasty in oxidized zirconium. *Acta Orthop Belg* 2015; **81**: 790-795 [PMID: 26790806]
13. Rajgopal A, Panda I, Tyagi VC. Early failure with massive metallosis and posteromedial wear following atraumatic anterior cruciate ligament rupture after medial unicompartmental knee arthroplasty. *Arthroplast Today* 2018; **4**: 15-19 [PMID: 29560389 DOI: 10.1016/j.artd.2017.09.007]
14. Kiran M, Kho J, Hepburn E, Chakraverty J, Davies H. Chronic Wear-Induced Bearing Dislocation in a Fixed-Bearing Unicompartmental Knee Arthroplasty: A Case Report. *JBJS Case Connect* 2021; **11** [PMID: 34491688 DOI: 10.2106/JBJS.CC.21.00364]
15. Pescador D, Calero-Paniagua I, Sánchez-González MD, Montilla C. Metallosis as a cause of pain and inflammation in a patient with a knee replacement: A case description. *Reumatol Clin* 2016; **12**: 112-113 [PMID: 26099454 DOI: 10.1016/j.reuma.2015.04.005]
16. Toro G, Braile A, Zappulo E, Panni AS, Indelli PF. Does D-Dimer really help in the diagnosis of chronic periprosthetic joint infections (PJI)? A case-control study. *Journal of Arthroscopy and Joint Surgery* 2020; **7**: 189-193 [DOI: 10.1016/j.jajs.2020.08.006]

- 17 **Panni AS**, Ascione F, Rossini M, Braile A, Corona K, Vasso M, Hirschmann MT. Tibial internal rotation negatively affects clinical outcomes in total knee arthroplasty: a systematic review. *Knee Surg Sports Traumatol Arthrosc* 2018; **26**: 1636-1644 [PMID: 29247357 DOI: 10.1007/s00167-017-4823-0]
- 18 **Vasso M**, Braile A, Ascione F, Toro G, De Cicco A, Lepore F, Schiavone Panni A. Two-stage reimplantation in periprosthetic knee infection. *Eur Rev Med Pharmacol Sci* 2019; **23**: 51-58 [PMID: 30977871 DOI: 10.26355/eurrev_201904_17474]
- 19 **Rollin L**, Darmoni S, Caillard JF, Gehanno JF. Searching for high-quality articles about intervention studies in occupational health--what is really missed when using only the Medline database? *Scand J Work Environ Health* 2010; **36**: 484-487 [PMID: 20740265 DOI: 10.5271/sjweh.3082]
- 20 **Pillastrini P**, Vanti C, Curti S, Mattioli S, Ferrari S, Violante FS, Guccione A. Using PubMed search strings for efficient retrieval of manual therapy research literature. *J Manipulative Physiol Ther* 2015; **38**: 159-166 [PMID: 25499192 DOI: 10.1016/j.jmpt.2014.11.005]
- 21 **Swiatkowska I**, Martin N, Hart AJ. Blood titanium level as a biomarker of orthopaedic implant wear. *J Trace Elem Med Biol* 2019; **53**: 120-128 [PMID: 30910194 DOI: 10.1016/j.jtemb.2019.02.013]
- 22 Cobalt Blood Level. Science Direct Topics. Available from: <https://www.sciencedirect.com/topics/nursing-and-health-professions/cobalt-blood-level>
- 23 **Johal S**, Nakano N, Baxter M, Hujazi I, Pandit H, Khanduja V. Unicompartmental Knee Arthroplasty: The Past, Current Controversies, and Future Perspectives. *J Knee Surg* 2018; **31**: 992-998 [PMID: 29514367 DOI: 10.1055/s-0038-1625961]
- 24 **Hernigou P**, Deschamps G. Posterior slope of the tibial implant and the outcome of unicompartmental knee arthroplasty. *J Bone Joint Surg Am* 2004; **86**: 506-511 [PMID: 14996875 DOI: 10.2106/00004623-200403000-00007]
- 25 **Crawford DA**, Berend KR, Lombardi AV. Management of the Failed Medial Unicompartmental Knee Arthroplasty. *J Am Acad Orthop Surg* 2018; **26**: e426-e433 [PMID: 30113345 DOI: 10.5435/JAAOS-D-17-00107]
- 26 **Lombardi AV Jr**, Kolich MT, Berend KR, Morris MJ, Crawford DA, Adams JB. Revision of Unicompartmental Knee Arthroplasty to Total Knee Arthroplasty: Is It as Good as a Primary Result? *J Arthroplasty* 2018; **33**: S105-S108 [PMID: 29691172 DOI: 10.1016/j.arth.2018.03.023]
- 27 **Epinette JA**, Leyder M, Saragaglia D, Pasquier G, Deschamps G; Société Française de la Hanche et du Genou. Is unicompartmental-to-unicompartmental revision knee arthroplasty a reliable option? Case-control study. *Orthop Traumatol Surg Res* 2014; **100**: 141-145 [PMID: 24373806 DOI: 10.1016/j.otsr.2013.10.013]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

Telephone: +1-925-3991568

E-mail: bpgoffice@wjgnet.com

Help Desk: <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

