Should surgical drain be used after routine primary total knee or total hip arthroplasty?

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Response/Recommendation: The use of surgical drains in routine primary total knee and total hip arthroplasty is not recommended.

Level of evidence: Moderate

Rationale: Surgical drains have been around since the 1960s, and used with the main purpose of avoiding hematoma in a surgical site. Many orthopedic surgeons also used surgical drains during the early years of arthroplasty (1). Again the main purpose of using surgical drains was to avoid hematoma formation and potential consequences of hematoma such as infection. One of the earlier reports on the benefits of surgical drains did indeed demonstrate a lower infection rate when drain was used. (2)

However, in recent decades and with the advancements in surgical and anaesthesia techniques, the use of surgical drains has declined (3,21,22). In fact, numerous high-level studies have shown the disadvantages of surgical drains in terms of increased blood loss, need for allogenic blood transfusion, and potential for introduction of infection into the surgical site. [3-40] Our search of literature revealed 38 high-level studies, in English language, related to the use of surgical drain after primary hip and knee arthroplasty. Of those, 24 papers were with patients after primary hip arthroplasty and 20 with primary knee arthroplasty, some studies include both knee and hip arthroplasty. Among these, 31 studies were RCTs and 7 well conducted systematic reviews.

Blood loss was the primary outcome in ten studies related to the hip and six studies related to the knee. Most of the authors used a modified Gross formula to calculate total blood loss, which takes into account the combined intraoperative and hidden blood loss. Of those papers, only 3 studies investigating hip replacement, and 2 studies of knee replacement patients showed statistically significant increased blood loss in the group with surgical drains. [5, 27, 30, 35, 35] The same pattern was also observed in the meta-analysis on hip patients [Figure 1]. In the knee replacement cohort there were no statistically significant differences in blood loss between the groups. [Figure 2]

Data on the need for allogeneic blood transfusion was provided in 31 studies. In 8 of those studies a statistically significant differences between groups were shown with the surgical drain cohort needing a higher rate of blood transfusion (4,7,12,14,24,28,29,36).

Other postoperative complications were also evaluated by many of these studies. The rate of complications for the most part was comparable between the cohorts with and without the use of surgical drains. One study, however, demonstrated a higher rate of reoperations in the surgical drain cohort.[35] In two papers there were differences in infection rate after surgery. One study, from China, in patients undergoing hip arthroplasty noted a higher rate of surgical site infection and prolonged wound discharge in patients without surgical drains.[15] In another study by Maliarov et al., the opposite was observed as patients undergoing total knee arthroplasty in whom surgical drain was used had a higher rate of deep and superficial infections.[35] In six studies there was a significant difference in the rate of prolonged wound

drainage and the need for dressing reinforcement. In five studies the wound problems occurred with higher frequency in patients without surgical drains while in another study by Johansson et al. the wound problem was seen more often in patients with surgical drains.[8]

A few studies have also evaluated pain with and without the use of surgical drains. However, the method evaluating this outcome is heterogeneous. It is difficult to glean a concrete conclusion related to pain from these studies. Three studies did demonstrate a lower Visual Analogue Scale (VAS) in patients with surgical drain, compared to those without, in patients undergoing total hip arthroplasty. While two other studies have shown the opposite.

Based on our understanding of the current literature, there is little evidence for the use of surgical drains in routine primary total hip and knee arthroplasty. The use of drain may paradoxically lead to a higher volume of blood loss, need for allogenic blood transfusion, and the potential for introduction of infection. In addition the cost associated with the use of surgical drains, besides the cost of drains, may include the higher rate of reoperations, possibly because of inadvertent suturing of the drain, and the need for a healthcare professional to remove the drain.

Bibliography

[1] Willett KM, Simmons CD, Bentley G. The effect of suction drains after total hip replacement. J Bone Joint Surg Br. 1988;70(4):607-610. doi:10.1302/0301-620X.70B4.3403607

[2] Waugh, Theodore R.; Stinchfield, Frank E.. Suction Drainage of Orthopaedic Wounds. The Journal of Bone & Joint Surgery 43(7):p 939-1021, October 1961

[3] Ritter MA, Keating EM, Faris PM. Closed wound drainage in total hip or total knee replacement. A prospective, randomized study. J Bone Joint Surg Am. 1994;76(1):35-38. doi:10.2106/00004623-199401000-00005

[4] Walmsley PJ, Kelly MB, Hill RMF, Brenkel I. A prospective, randomised, controlled trial of the use of drains in total hip arthroplasty. J Bone Joint Surg Br. 2005;87-B(10):1397-1401. doi:10.1302/0301-620X.87B10.16221

[5] Jennings JM, Loyd BJ, Miner TM, Yang CC, Stevens-Lapsley J, Dennis DA. A prospective randomized trial examining the use of a closed suction drain shows no influence on strength or function in primary total knee arthroplasty. Bone Joint J. 2019;101-B(7_Supple_C):84-90. doi:10.1302/0301-620X.101B7.BJJ-2018-1420.R1

[6] Fleischmann F, Matuschek C, Orth K, et al. Aprotinin and classic wound drainage are unnecessary in total hip replacement - a prospective randomized trial. Eur J Med Res. 2011;16(1):20-28. doi:10.1186/2047-783x-16-1-20

[7] Zhang Q, Liu L, Sun W, et al. Are closed suction drains necessary for primary total knee arthroplasty?: A systematic review and meta-analysis. Medicine (Baltimore). 2018;97(30):e11290. doi:10.1097/MD.0000000000011290

[8] Johansson T, Engquist M, Pettersson LG, Lisander B. Blood loss after total hip replacement: a prospective randomized study between wound compression and drainage. J Arthroplasty. 2005;20(8):967-971. doi:10.1016/j.arth.2005.02.004

[9] Erne F, Wetzel S, Wülker N, Gesicki M, Hofmann UK. Closed Suction Drainage after Primary Total Knee Arthroplasty: A Prospective Randomized Trial. J Knee Surg. 2018;31(8):804-810. doi:10.1055/s-0037-1615297

[10] Suarez JC, McNamara CA, Barksdale LC, Calvo C, Szubski CR, Patel PD. Closed Suction Drainage Has No Benefits in Anterior Hip Arthroplasty: A Prospective, Randomized Trial. J Arthroplasty. 2016;31(9):1954-1958. doi:10.1016/j.arth.2016.02.048

[11] Wang D, Xu J, Zeng WN, et al. Closed Suction Drainage Is Not Associated with Faster Recovery after Total Knee Arthroplasty: A Prospective Randomized Controlled Study of 80 Patients. Orthop Surg. 2016;8(2):226-233. doi:10.1111/os.12247

[12] Migliorini F, Maffulli N, Betsch M, Eschweiler J, Tingart M, Baroncini A. Closed suction drainages in Lower Limb Joint Arthroplasty: A level I evidence based meta-analysis. Surgeon. 2022;20(3):e51-e60. doi:10.1016/j.surge.2021.02.014

[13] Bartosz P, Marczyński W, Para M, Kogut M, Białecki J. Comparative study of suction drainage placement in cementless hip replacement among patients undergoing extended thromboprophylaxis: a prospective randomized study. BMC Musculoskelet Disord. 2021;22(1):688. Published 2021 Aug 13. doi:10.1186/s12891-021-04583-0

[14] Zhang QD, Guo WS, Zhang Q, Liu ZH, Cheng LM, Li ZR. Comparison between closed suction drainage and nondrainage in total knee arthroplasty: a meta-analysis. J Arthroplasty. 2011;26(8):1265-1272. doi:10.1016/j.arth.2011.02.005

[15] Zeng WN, Zhou K, Zhou ZK, et al. Comparison between drainage and non-drainage after total hip arthroplasty in Chinese subjects. Orthop Surg. 2014;6(1):28-32. doi:10.1111/os.12092

[16] Strahovnik A, Fokter SK, Kotnik M. Comparison of drainage techniques on prolonged serous drainage after total hip arthroplasty. J Arthroplasty. 2010;25(2):244-248. doi:10.1016/j.arth.2008.08.014

[17] Zhou XD, Li J, Xiong Y, Jiang LF, Li WJ, Wu LD. Do we really need closed-suction drainage in total hip arthroplasty? A meta-analysis. Int Orthop. 2013;37(11):2109-2118. doi:10.1007/s00264-013-2053-8

[18] Matsuda K, Nakamura S, Wakimoto N, Kobayashi M, Matsushita T. Drainage does not increase anemia after cementless total hip arthroplasty. Clin Orthop Relat Res. 2007;458:101-105. doi:10.1097/BLO.0b013e31802ea45f

[19] Fan Y, Liu Y, Lin J, et al. Drainage does not promote post-operative rehabilitation after bilateral total knee arthroplasties compared with nondrainage. Chin Med Sci J. 2013;28(4):206-210. doi:10.1016/s1001-9294(14)60003-1

[20] Niskanen RO, Korkala OL, Haapala J, Kuokkanen HO, Kaukonen JP, Salo SA. Drainage is of no use in primary uncomplicated cemented hip and knee arthroplasty for osteoarthritis: a prospective randomized study. J Arthroplasty. 2000;15(5):567-569. doi:10.1054/arth.2000.6616

[21] Kim YH, Cho SH, Kim RS. Drainage versus nondrainage in simultaneous bilateral total hip arthroplasties. J Arthroplasty. 1998;13(2):156-161. doi:10.1016/s0883-5403(98)90093-6

[22] Kim YH, Cho SH, Kim RS. Drainage versus nondrainage in simultaneous bilateral total knee arthroplasties. Clin Orthop Relat Res. 1998;(347):188-193.

[23] Mortazavi SMJ, Firoozabadi MA, Najafi A, Mansouri P. Evaluation of outcomes of suction drainage in patients with haemophilic arthropathy undergoing total knee arthroplasty. Haemophilia. 2017;23(4):e310-e315. doi:10.1111/hae.13224

[24] Lychagin AV, Rosenberg N, Gritsyuk AA. Evaluation of the potential complications of surgical wound drainage in primary total hip arthroplasty: a prospective controlled double-blind study. Hip Int. 2021;31(5):589-592. doi:10.1177/1120700020941749

[25] Koyano G, Jinno T, Koga D, Hoshino C, Muneta T, Okawa A. Is closed suction drainage effective in early recovery of hip joint function? Comparative evaluation in one-stage bilateral total hip arthroplasty. J Arthroplasty. 2015;30(1):74-78. doi:10.1016/j.arth.2014.08.007

[26] Crevoisier XM, Reber P, Noesberger B. Is suction drainage necessary after total joint arthroplasty? A prospective study. Arch Orthop Trauma Surg. 1998;117(3):121-124. doi:10.1007/s004020050210

[27] Omonbude D, El Masry MA, O'Connor PJ, Grainger AJ, Allgar VL, Calder SJ. Measurement of joint effusion and haematoma formation by ultrasound in assessing the effectiveness of drains after total knee replacement: A prospective randomised study. J Bone Joint Surg Br. 2010;92(1):51-55. doi:10.1302/0301-620X.92B1.22121

[28] Li C, Nijat A, Askar M. No clear advantage to use of wound drains after unilateral total knee arthroplasty: a prospective randomized, controlled trial. J Arthroplasty. 2011;26(4):519-522. doi:10.1016/j.arth.2010.05.031

[29] Si HB, Yang TM, Zeng Y, Shen B. No clear benefit or drawback to the use of closed drainage after primary total knee arthroplasty: a systematic review and meta-analysis. BMC Musculoskelet Disord. 2016;17:183. Published 2016 Apr 26. doi:10.1186/s12891-016-1039-2

[30] Jenny JY, Boeri C, Lafare S. No drainage does not increase complication risk after total knee prosthesis implantation: a prospective, comparative, randomized study. Knee Surg Sports Traumatol Arthrosc. 2001;9(5):299-301. doi:10.1007/s001670100220

[31] Widman J, Jacobsson H, Larsson SA, Isacson J. No effect of drains on the postoperative hematoma volume in hip replacement surgery: a randomized study using scintigraphy. Acta Orthop Scand. 2002;73(6):625-629. doi:10.1080/000164702321039570

[32] González Della Valle A, Slullitel G, Vestri R, Comba F, Buttaro M, Piccaluga F. No need for routine closed suction drainage in elective arthroplasty of the hip: a prospective randomized trial in 104 operations. Acta Orthop Scand. 2004;75(1):30-33. doi:10.1080/00016470410001708050

[33] Zhou K, Wang H, Li J, Wang D, Zhou Z, Pei F. Non-drainage versus drainage in tourniquet-free knee arthroplasty: a prospective trial. ANZ J Surg. 2017;87(12):1048-1052. doi:10.1111/ans.14183

[34] Dora C, von Campe A, Mengiardi B, Koch P, Vienne P. Simplified wound care and earlier wound recovery without closed suction drainage in elective total hip arthroplasty. A prospective randomized trial in 100 operations. Arch Orthop Trauma Surg. 2007;127(10):919-923. doi:10.1007/s00402-006-0260-0

[35] Maliarov A, Newman N, Sabouret P, Al-Shakfa F, Chergui S, Lavoie F. Suction drainage in total knee replacement does not influence early functional outcomes or blood loss: a randomized control trial. Arthroplasty. 2023;5(1):8. Published 2023 Feb 20. doi:10.1186/s42836-022-00158-z

[36] Kelly EG, Cashman JP, Imran FH, Conroy R, O'Byrne J. Systematic review and meta-analysis of closed suction drainage versus non-drainage in primary hip arthroplasty. Surg Technol Int. 2014;24:295-301.

[37] Esler CN, Blakeway C, Fiddian NJ. The use of a closed-suction drain in total knee arthroplasty. A prospective, randomised study. J Bone Joint Surg Br. 2003;85(2):215-217. doi:10.1302/0301-620x.85b2.13357

[38] Fagotti L, Ejnisman L, Miyahara HS, Gurgel HMC, Croci AT, Vicente JRN. Use of closed suction drainage after primary total hip arthroplasty: a prospective randomized controlled trial. Rev Bras Ortop. 2018;53(2):236-243. Published 2018 Jan 18. doi:10.1016/j.rboe.2018.01.001

[39] von Roth P, Perka C, Dirschedl K, et al. Use of Redon drains in primary total hip arthroplasty has no clinically relevant benefits. Orthopedics. 2012;35(11):e1592-e1595. doi:10.3928/01477447-20121023-14

[40] Parker MJ, Roberts CP, Hay D. Closed suction drainage for hip and knee arthroplasty. A meta-analysis. J Bone Joint Surg Am. 2004;86(6):1146-1152. doi:10.2106/00004623-200406000-00005

Figures:

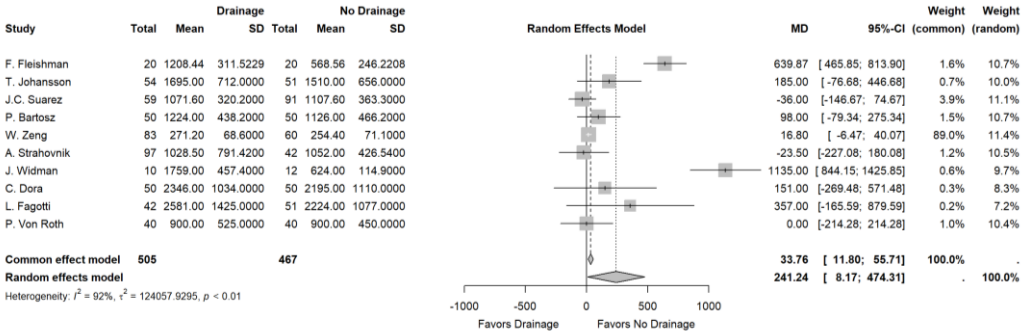

Figure 1: Forest Plot examining the studies related to blood loss and the use of drain after primary total hip arthroplasty

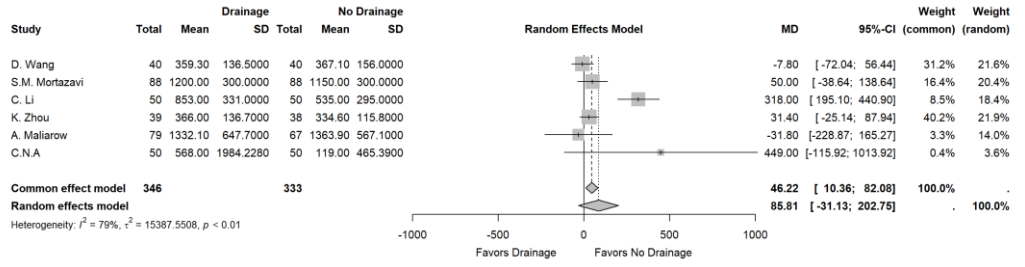

Figure 2: Forest Plot examining the studies related to blood loss the use of drain after primary total knee arthroplasty