

## QUESTION 7: Does preoperative urinary tract infection (UTI) (symptomatic and asymptomatic) increase the risk for subsequent surgical site infection/periprosthetic joint infection (SSI/PJI)?

---

RECOMMENDATION: Symptomatic UTI must be treated with appropriate antibiotics before proceeding with the surgery. In asymptomatic bacteriuria (ASB), treatment should be discontinued as it does not increase the risk of a subsequent SSI/PJI.

LEVEL OF EVIDENCE: Strong

DELEGATE VOTE: Agree: 96%, Disagree: 2%, Abstain: 2% (Unanimous, Strongest Consensus)

---

### RATIONALE

Urinary tract infections (UTIs) can present as symptomatic with fever, pain, raised leucocytes and large amount of pus cells in the urine or as asymptomatic bacteremia without any symptoms but  $> 10^5$  CFU/ml in urine culture (two consecutive samples with the same organism in women and one sample in men) [1]. A correlation between UTI and PJI was first described in several case reports in the 1970s. However, there is a lack of evidence to support that correlation.

Reportedly, the prevalence of preoperative UTI ranged from 5.1 to 36% in female patients undergoing arthroplasties [2–10]. Most of these studies reported that patients with or without a positive urine culture had comparable PJI rates following arthroplasties [2–7,9,10]. On the other hand, one study reported that UTIs by gram-negative bacteria are a risk factor for PJI. However, that report could be biased because the insertion of urinary catheters, which is an important risk factor for PJI, was not stratified and the microorganisms in the PJI wounds were not the same as the isolates from the urine cultures [8].

The incidence of PJI ranges from 0.3 to 1% [11,12]. Distant seeding accounts for 10 to 20% of PJIs, and UTIs are estimated to be responsible for 13% of PJIs due to distant seeding [13]. By calculation, UTI accounts for only 0.01 to 0.05% of total PJIs. The frequency of ABU varies widely according to age, sex and population characteristics. Assuming that the prevalence of ABU is 5%, approximately 200,000 PJI patients are required to determine the causality of UTI for PJI. Such a study is barely feasible.

Urine culture is the most common diagnostic tool for UTI. However, the diagnostic accuracy of a urine culture is reduced in cases of inadequate preparation, sampling error and contamination during the collection of urine. Moreover, there is an inconsistency in the cutoff for diagnostic bacterial counts ( $> 10^5$  colony-forming units of a microorganism or  $> 10^3$  colony-forming units of a microorganism) [4,5]. Due to heterogeneity of diagnostic tests and different diagnostic criteria of UTIs, it was difficult to collect the overall data, to compare the results across the studies and to draw a convincing conclusion.

### Evidence for Preoperative UTI as a Potential Risk Factor

In 2003, the American Urology Association (AUA) and the American Academy of Orthopaedic Surgeons (AAOS) conducted a case control study of 47 cases and 200 controls and jointly identified urinary tract infections as an important risk factor for PJIs among other risk factors [14]. Luis et al. conducted a prospective review of 9,245 patients with joint arthroplasties and identified preoperative UTI as an important modifiable risk factor for PJIs and instituted preoperative screening and treatment for UTI before proceeding for surgery [11]. Yassa et al. conducted a retrospective cohort analysis of patients who underwent an emergency surgery within 24 hours for femoral neck fractures and examined the prevalence of urinary tract associated PJIs in these patients. Out of the 367 patients enrolled, 57 (12.4%) had a surgical site infection with 23 (40%) having a preoperative UTI. They concluded that a preoperative UTI is an important risk factor for PJI and requires treatment [15].

However, a study by Kuolovaris et al. reviewed medical records of 19,735 patients and did not find any relationship between preoperative UTIs and PJIs. Only one of their 58 patients had a PJI due to the same organism causing a UTI. However, this was an underpowered study ( $\beta = 25\%$ ). Another study by Garg et al. showed that preoperative UTIs, when adequately treated with appropriate antibiotics, have similar outcomes as non-UTI patients [16]. Thus, symptomatic preoperative UTIs must be treated before proceeding with surgery.

### Evidence for Preoperative Asymptomatic Bacteriuria (ASB)

A cohort study conducted by Glynn et al. in 1984 showed that ASB predisposes to superficial wound infections, though the organisms were different from that of the urine culture [3]. In another retrospective cohort study, Ritter et al. enrolled 277 patients who underwent arthroplasty, and 35 cases of preoperative ASB were identified. During the follow-up period, varying from one to 16 years, they identified three cases of PJI, but none were related to the preoperative ASB [17]. Ollivere et al., in their prospective study of 600 patients, showed that 36% of their patients with ASB had some form of delayed wound infections vs. 16% in the non-ASB group. They concluded that patients with ASB should be recognized as a high-risk subgroup for wound infections postoperatively irrespective of their treatment [18].

A randomized controlled trial of 441 patients undergoing arthroplasty found 42 patients with asymptomatic bacteriuria. Patients were randomized to specific urinary treatment (Group A) and no specific treatment (Group B) if the urine culture was positive. Six patients each in group A and B had wound infections after three months of follow-up. None of the organisms were similar to that of the urine culture. Thus, no urinary origin of PJI was identified in patients with asymptomatic bacteriuria irrespective of whether treatment was given or not [2]. A multicentric cohort study conducted by Sousa et al. found an ASB prevalence of 12.1% among 2,497 patients. They observed that the PJI rate was significantly higher in the ASB group than in the non-ASB group (4.3 vs. 1.4%; odds ratio (OR) 3.23, 95% confidence interval (CI), 1.67 to 6.27,  $p = .001$ ). However, in the ASB group, there was no significant difference in PJI rate between treated (3.9%) and untreated (4.7%) patients. They concluded that preoperative treatment of ASB did not show any benefit and could not be recommended [8]. Other studies by Martinez et al., Gou et al. and Bouvet et al. also suggest similar findings

[5,19,20]. Systematic reviews and a meta-analysis conducted by the European Association of Urology, Mayne et al. and Zhang et al. also concluded that detection and treatment of ASB has no benefit for patients undergoing joint arthroplasty [21–23].

All of these studies have cautioned against the adverse effects of antibiotics such as drug resistance, economic burden and potential allergies. A study conducted with the help of a multidisciplinary team comprised of orthopaedic surgeons, hospitalists, preoperative clinic nurses, infection control professionals, infectious diseases physicians and microbiologists decided to change their policy regarding preoperative urine culture screening, and no screening cultures were to be sent before an elective primary joint arthroplasty (EJA). A total of 5,414 primary EJAs were enrolled over a three-year period. Of these, 3,523 were in the baseline period, and 1,893 were during the intervention period. They did not find a significant increase in PJI in the intervention phase. Also, discontinuation of urine screening led to cost savings by eliminating urine cultures and also the cost of antibiotics prescribed for ASB; thus, there is good evidence to stop screening and treatment of patients for asymptomatic bacteriuria as it does not increase the risk of PJIs [24].

## REFERENCES

- [1] Nicolle LE, Bradley S, Colgan R, Rice JC, Schaeffer A, Hooton TM, et al. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. *Clin Infect Dis*. 2005;40:643–654. doi:10.1086/427507.
- [2] Cordero-Ampuero J, González-Fernández E, Martínez-Vélez D, Esteban J. Are antibiotics necessary in hip arthroplasty with asymptomatic bacteriuria? Seeding risk with/without treatment. *Clin Orthop Relat Res*. 2013;471:3822–3829. doi:10.1007/s11999-013-2868-z.
- [3] Glynn MK, Sheehan JM. The significance of asymptomatic bacteriuria in patients undergoing hip/knee arthroplasty. *Clin Orthop Relat Res*. 1984:151–154.
- [4] Juthani-Mehta M. Asymptomatic bacteriuria and urinary tract infection in older adults. *Clin Geriatr Med*. 2007;23:585–594, vii. doi:10.1016/j.cger.2007.03.001.
- [5] Martínez-Vélez D, González-Fernández E, Esteban J, Cordero-Ampuero J. Prevalence of asymptomatic bacteriuria in knee arthroplasty patients and subsequent risk of prosthesis infection. *Eur J Orthop Surg Traumatol*. 2016;26:209–214. doi:10.1007/s00590-015-1720-4.
- [6] Park CH, Lee YK, Koo KH. Lower urinary tract infection and periprosthetic joint infection after elective primary total hip arthroplasty. *Hip Pelvis*. 2017;29:30–34. doi:10.5371/hp.2017.29.1.30.
- [7] Singh H, Thomas S, Agarwal S, Arya SC, Srivastav S, Agarwal N. Total knee arthroplasty in women with asymptomatic urinary tract infection. *J Orthop Surg (Hong Kong)*. 2015;23:298–300. doi:10.1177/230949901502300307.
- [8] Sousa R, Muñoz-Mahamud E, Quayle J, Dias da Costa L, Casals C, Scott P, et al. Is asymptomatic bacteriuria a risk factor for prosthetic joint infection? *Clin Infect Dis*. 2014;59:41–47. doi:10.1093/cid/ciu235.
- [9] Wymenga AB, van Horn JR, Theeuwes A, Muyltjens HL, Slooff TJ. Perioperative factors associated with septic arthritis after arthroplasty. Prospective multicenter study of 362 knee and 2,651 hip operations. *Acta Orthop Scand*. 1992;63:665–671.
- [10] Wilson MG, Kelley K, Thornhill TS. Infection as a complication of total knee–replacement arthroplasty. Risk factors and treatment in sixty–seven cases. *J Bone Joint Surg Am*. 1990;72:878–883.
- [11] Pulido L, Ghanem E, Joshi A, Purtill JJ, Parvizi J. Periprosthetic joint infection: the incidence, timing, and predisposing factors. *Clin Orthop Relat Res*. 2008;466:1710–1715. doi:10.1007/s11999-008-0209-4.
- [12] Kurtz SM, Lau E, Schmier J, Ong KL, Zhao K, Parvizi J. Infection burden for hip and knee arthroplasty in the United States. *J Arthroplasty*. 2008;23:984–991. doi:10.1016/j.arth.2007.10.017.
- [13] Maderazo EG, Judson S, Pasternak H. Late infections of total joint prostheses. A review and recommendations for prevention. *Clin Orthop Relat Res*. 1988:131–142.
- [14] American Urological Association, American Academy of Orthopaedic Surgeons. Antibiotic prophylaxis for urological patients with total joint replacements. *J Urol*. 2003;169:1796–1797. doi:10.1097/01.ju.0000062420.06536.57.
- [15] Yassa RR, Khalfauoi MY, Veravalli K, Evans DA. Pre–operative urinary tract infection: is it a risk factor for early surgical site infection with hip fracture surgery? A retrospective analysis. *JRSM Open*. 2017;8:2054270416675083. doi:10.1177/2054270416675083.
- [16] Koulouvaris P, Sculco P, Finerty E, Sculco T, Sharrock NE. Relationship between perioperative urinary tract infection and deep infection after joint arthroplasty. *Clin Orthop Relat Res*. 2009;467:1859–1867. doi:10.1007/s11999-008-0614-8.
- [17] Ritter MA, Fechtman RW. Urinary tract sequelae: possible influence on joint infections following total joint replacement. *Orthopedics*. 1987;10:467–469.
- [18] Ollivere BJ, Ellahee N, Logan K, Miller–Jones JCA, Allen PW. Asymptomatic urinary tract colonisation predisposes to superficial wound infection in elective orthopaedic surgery. *Int Orthop*. 2009;33:847–850. doi:10.1007/s00264-008-0573-4.
- [19] Gou W, Chen J, Jia Y, Wang Y. Preoperative asymptomatic leucocyturia and early prosthetic joint infections in patients undergoing joint arthroplasty. *J Arthroplasty*. 2014;29:473–476. doi:10.1016/j.arth.2013.07.028.
- [20] Bouvet C, Lübbecke A, Bandi C, Pagani L, Stern R, Hoffmeyer P, et al. Is there any benefit in pre–operative urinary analysis before elective total joint replacement? *Bone Joint J*. 2014;96–B:390–394. doi:10.1302/0301-620X.96B3.32620.
- [21] Köves B, Cai T, Veeratterapillay R, Pickard R, Seisen T, Lam TB, et al. Benefits and harms of treatment of asymptomatic bacteriuria: a systematic review and meta–analysis by the European Association of Urology Urological Infection Guidelines Panel. *Eur Urol*. 2017;72:865–868. doi:10.1016/j.eururo.2017.07.014.
- [22] Mayne AIW, Davies PSE, Simpson JM. Antibiotic treatment of asymptomatic bacteriuria prior to hip and knee arthroplasty; a systematic review of the literature. *Surgeon*. 2018;16:176–182. doi:10.1016/j.surge.2017.08.007.
- [23] Zhang Q, Liu L, Sun W, Gao F, Cheng L, Li Z. Research progress of asymptomatic bacteriuria before arthroplasty: A systematic review. *Medicine (Baltimore)*. 2018;97:e9810. doi:10.1097/MD.00000000000009810.
- [24] Lamb MJ, Baillie L, Pajak D, Flynn J, Bansal V, Simor A, et al. Elimination of Screening Urine Cultures Prior to Elective Joint Arthroplasty. *Clin Infect Dis*. 2017;64:806–809. doi:10.1093/cid/ciw848.

