

- [8] Maruo K, Berven SH. Outcome and treatment of postoperative spine surgical site infections: predictors of treatment success and failure. *J Orthop Sci.* 2014;19:398–404. doi:10.1007/s00776-014-0545-z.
- [9] Messina AF, Berman DM, Ghazarian SR, Patel R, Neustadt J, Hahn G, et al. The management and outcome of spinal implant-related infections in pediatric patients: a retrospective review. *Pediatr Infect Dis J.* 2014;33:720–723. doi:10.1097/INF.0000000000000264.
- [10] Chen SH, Lee CH, Huang KC, Hsieh H, Tsai SY. Postoperative wound infection after posterior spinal instrumentation: analysis of long-term treatment outcomes. *Eur Spine J.* 2015;24:561–570. doi:10.1007/s00586-014-3636-9.
- [11] Miyazaki S, Kakutani K, Maeno K, Takada T, Yurube T, Kurosaka M, et al. Surgical debridement with retention of spinal instrumentation and long-term antimicrobial therapy for multidrug-resistant surgical site infections after spinal surgery: a case series. *Int Orthop.* 2016;40:1171–1177. doi:10.1007/s00264-015-3073-3.
- [12] Billières J, Uçkay I, Faundez A, Douissard J, Kuczmarski P, Suvà D, et al. Variables associated with remission in spinal surgical site infections. *J Spine Surg.* 2016;2:128–134. doi:10.21037/jss.2016.06.06.
- [13] Wille H, Dauchy FA, Desclaux A, Dutronc H, Vareil MO, Dubois V, et al. Efficacy of debridement, antibiotic therapy and implant retention within three months during postoperative instrumented spine infections. *Infect Dis (Lond).* 2017;49:261–267. doi:10.1080/23744235.2016.1255351.
- [14] Takizawa T, Tsutsumimoto T, Yui M, Misawa H. Surgical site infections caused by methicillin-resistant *Staphylococcus epidermidis* after spinal instrumentation surgery. *Spine.* 2017;42:525–530. doi:10.1097/BRS.0000000000001792.
- [15] Collins I, Wilson-MacDonald J, Chami G, Burgoyne W, Vineyakam P, Berendt T, et al. The diagnosis and management of infection following instrumented spinal fusion. *Eur Spine J.* 2008;17:445–450. doi:10.1007/s00586-007-0559-8.

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QUESTION 8: What tests should be used to monitor response to antibiotic treatment in patients with spine infection?

RECOMMENDATION: Serum C-reactive protein (CRP) levels are closely related to clinical response in spine infections and are therefore the preferred marker in monitoring the therapeutic course.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 93%, Disagree: 7%, Abstain: 0% (Super Majority, Strong Consensus)

RATIONALE

In two large retrospective studies including 363 patients, criteria for discontinuation of treatment included CRP normalization in addition to resolution of clinical symptoms [1,2]. A weekly decrease of CRP by 50% has been suggested as a therapeutic response in the retrospective study population [3].

Lack of normalization of serum CRP levels is a predictor of treatment failure and warrants additional evaluation, as demonstrated both by a retrospective cohort including 79 patients and a prospective study including 21 patients followed for postsurgical wound infections of the spine [4–5].

Moreover, in a retrospective analysis of 61 patients treated for bacterial spondylodiscitis, the only predictor for de-escalating intravenous therapy to highly bioavailable oral agents was a CRP decrease by week 2 of therapy [6].

REFERENCES

- [1] Legrand E, Flipo RM, Guggenbuhl P, Masson C, Maillefert JF, Soubrier M, et al. Management of nontuberculous infectious discitis. Treatments used in 110 patients admitted to 12 teaching hospitals in France. *Joint Bone Spine.* 2001;68:504–509.
- [2] McHenry MC, Easley KA, Locker GA. Vertebral osteomyelitis: long-term outcome for 253 patients from 7 Cleveland-area hospitals. *Clin Infect Dis.* 2002;34:1342–1350. doi:10.1086/340102.
- [3] Legrand E, Massin P, Levasseur R, Hoppé E, Chappard D, Audran M. Stratégie diagnostique et principes thérapeutiques au cours des spondylodiscites infectieuses bactériennes. *Revue Du Rhumatisme.* 2006;73:373–379. doi:10.1016/j.rhum.2006.01.005.
- [4] Khan MH, Smith PN, Rao N, Donaldson WF. Serum C-reactive protein levels correlate with clinical response in patients treated with antibiotics for wound infections after spinal surgery. *Spine J.* 2006;6:311–315. doi:10.1016/j.spinee.2005.07.006.
- [5] Kowalski TJ, Berbari EF, Huddleston PM, Steckelberg JM, Osmon DR. Do follow-up imaging examinations provide useful prognostic information in patients with spine infection? *Clin Infect Dis.* 2006;43:172–179. doi:10.1086/505118.
- [6] Babouee Flury B, Elzi L, Kolbe M, Frei R, Weisser M, Schären S, et al. Is switching to an oral antibiotic regimen safe after 2 weeks of intravenous treatment for primary bacterial vertebral osteomyelitis? *BMC Infect Dis.* 2014;14:226. doi:10.1186/1471-2334-14-226.

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QUESTION 9: Which is the best alternative antimicrobial therapy for fluoroquinolone-resistant gram-negative acute post-surgical infection in spinal surgery?

RECOMMENDATION: The choice of antimicrobial therapy should be based on the pathogen and the susceptibility profile.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 93%, Disagree: 7%, Abstain: 0% (Super Majority, Strong Consensus)