



# Utilization, Utility, and Variability in Usage of Adjunctive Hyperbaric Oxygen Therapy in Spinal Management: A Review of the Literature

[Kurt D Knepley](#), [Jennifer Z Mao](#), [Patrick S Laird](#), [Nicholas S Imperato](#), [Asham Khan](#),  
[Justice O Agyei](#), [Tim E O'Connor](#), [John Pollina](#), [Jeffrey P Mullin](#)

The objective of this review was to understand the clinical utilization, utility, and variability in the usage of adjunctive hyperbaric oxygen therapy (HBOT). Surgical site infection is associated with high morbidity and mortality, increased health care expenditure, and decreased quality of life. With the increasing prevalence of adult spinal deformity and spinal fusion surgery, it is imperative to understand the potential benefits of adjunctive treatments. HBOT is a safe and common procedure indicated to treat various medical conditions. We conducted a literature search across 3 databases for English articles published between December 1, 2019 and December 1, 2000. Thirteen studies were included. HBOT may lessen the duration of antimicrobial therapy and mitigate instrument removal and revision surgery. The current usage indications for HBOT are supported by level III evidence for chronic osteomyelitis and level IV evidence for osteoradionecrosis. However, the same level of evidence exists to support the beneficial use of adjunctive HBOT for noncomplicated spinal infections within 2 months after surgery. When cultured, the most common organisms were *Staphylococcus aureus* and other low-virulence organisms. The most common treatment protocol consists of 90-minute sessions of 100%  $\text{Fio}_2$  at 2-3 atmosphere absolute with a mean of  $35.3 \pm 11.6$  sessions for  $5.2 \pm 1.4$  weeks. Adjunctive HBOT should be considered in select high-risk patients. Further improvements in diagnosis and categorization of spinal infections are necessary and will indelibly aid the decision making for the initiation of HBOT.

**Table 1. Description of Included Studies and Clinical Use**

Reference	Year	Evidence Level	N	Women	Mean Age (years)*	Follow-Up (months)	Clinical Use†	Outcome Measure Indicating Successful Treatment
Inanmaz et al. <sup>24</sup>	2014	III	42	NA	16	39 (18–66)	In prevention of postoperative deep infection in patients with neuromuscular scoliosis	17% infection rate with hyperbaric oxygen therapy
Körpınar et al. <sup>6</sup>	2019	III	19	10	57	11 (1–36)	In the treatment of pyogenic spinal infections	92% recovery rate
Ahmed et al. <sup>25</sup>	2009	IV	6	3	53	23 (5–60)	In the treatment of spinal osteomyelitis	83% recovery rate (without relapse)
Eltorai et al. <sup>26</sup>	1984	III	44	0	(24–83)	(6–108)	In patients with spinal cord injury with chronic osteomyelitis	68% recovery rate
Kutlay et al. <sup>7</sup>	2008	III	22	8	45	24	In postoperative discitis	100% recovery rate‡
Onen et al. <sup>27</sup>	2015	IV	19	9	55	23 (10–50)	In refractory iatrogenic spinal infections	100% recovery rate (without revision)
Tofuku et al. <sup>13,§</sup>	2014	III	23	10	69	28 (12–48)	Adjunctive to percutaneous drainage in pyogenic spondylitis with iliopsoas abscess	100% recovery rate
Kohshi et al. <sup>28</sup>	2005	IV	1	0	49	6	In cervical epidural abscess	100% recovery rate
Topuz et al. <sup>29</sup>	2009	III	35	16	(25–29)	60	In spinal tuberculosis with antituberculosis agents and surgical debridement	100% recovery rate‡
Larsson et al. <sup>13,§</sup>	2002	III	7	23	45	30 (17–46)	In neurosurgical infections after craniotomies or laminectomies	60% noninstrumentation removal
Larsson et al. <sup>30</sup>	2011	IV	6	NA	11	54 (37–72)	In pediatric patients with neuromuscular spine deformities for deep postoperative infections	100% recovery rate
West et al. <sup>31</sup>	2019	IV	2	0	53	18	In the setting of craniocervical posterior fusion	80% outcome improvement
Donovan et al. <sup>32</sup>	2005	IV	3	0	67	48	In the setting of cervical osteoradionecrosis undergoing vascularized fibular graft and craniocervical posterior fusion	100% recovery rate

NA, not available (patient genders were not specified by the authors).  
 \*Two studies only reported age range.  
 †Utility of adjunctive hyperbaric oxygen therapy to antibiotic use unless otherwise specified.  
 ‡Reported 0% recurrence rate and was converted for table consistency.  
 §Only those who underwent spinal surgery in this study are included in this review.