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Weightbearing Protocols and Outcomes in Open Surgical Management of Haglund Syndrome: A Large Retrospective Analysis

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Abstract

Background: Following insertional Achilles tendinopathy debridement and Haglund prominence resection for Haglund syndrome, patients undergo varying degrees of weightbearing limitation (weightbearing as tolerated [WBAT], partial weightbearing [PWB], touchdown weightbearing [TDWB], and nonweightbearing [NWB]). Given the scarcity of large-scale literature on the topic, the purpose of this study is to evaluate the impact of postoperative weightbearing protocols on outcomes after open surgical management of Haglund syndrome.

Methods: This was a retrospective cohort study of patients who underwent open surgical management for Haglund syndrome between January 2015 and December 2023 at a single academic institution by fellowship-trained foot and ankle surgeons. Patients were excluded if they underwent concurrent operative management of additional foot pathologies. Patient demographics, comorbidities, surgical techniques, and postoperative weightbearing protocols were recorded. Complications (Achilles tendon rupture, wound breakdown/infection, persistent pain, plantarflexion weakness) and revision rates were compared across weightbearing protocols. Statistical analysis was conducted using R with significance set at $P < .05$.

Results: Three-hundred eighty-seven patients were included (mean age 55.2 years, 66.1% female) with a mean follow-up of 10.1 (range: 0-86.3) months. The most common regimen was NWB (n = 268; 69.3%) followed by TDWB (n = 56; 14.5%), WBAT (n = 54; 14.0%), and PWB (n = 9; 2.3%). There were no significant differences in complications between the weightbearing protocols ($P = .48354$). Complications included persistent pain (n = 40; 10.3%), weakness (n = 6; 1.6%), wound breakdown/infection (n = 33; 8.5%), and rupture (n = 1; 0.3%)]. Revision surgery occurred in 1.8% (n = 7).

Conclusion: This large cohort study found no significant association between postoperative weightbearing protocols and outcomes following open surgical treatment for Haglund syndrome at a mean follow-up of 10.1 months. This study provides evidence that surgeons can individualize appropriate weightbearing protocols based on patient needs and preferences when treating Haglund syndrome with Achilles debridement and Haglund resection.

Level of Evidence: Level III, comparative study.

Keywords: weightbearing, Haglund, rehabilitation, outcomes, insertional Achilles tendinitis

Introduction

Haglund deformity is a posterior superior calcaneal prominence that can cause retrocalcaneal bursal irritation as well as insertional Achilles tendinopathy, collectively known as Haglund syndrome.[4,12,24,26] Although a conservative approach is the mainstay of initial management, multiple surgical techniques have been reported in the setting of refractory cases.[2,8] Surgical options span from endoscopic procedures[9] to open approaches[19] to accomplish bony debridement, calcaneal osteotomy, Achilles debridement, and often, subsequent Achilles fixation.[1,11,14]

After foot and ankle surgery, patients are immobilized in the postoperative period with varying degrees of weightbearing limitation.[6,15] In a systematic review and meta-analysis of 20 studies by Yuen et al,[26] the widespread differences between postoperative immobilization and weightbearing protocols was demonstrated. These protocols range from immediate weightbearing and range of motion to nonweightbearing for various periods of time. Although it was not specifically analyzed in the study, most open approach studies restricted weightbearing more aggressively, whereas there was a more liberal advancement of weightbearing postoperatively in the endoscopic groups. The earliest return to play in both groups was 6 weeks.[26] Of note, all studies included fewer than 100 procedures, with most containing 50 or fewer procedures for analysis.

This study demonstrates the need for further analysis on the influence of postoperative weightbearing status. Given the scarcity of large-scale literature on the topic, the goal of this study is to evaluate the impact of postoperative weightbearing protocols on outcomes after open surgical management of Haglund syndrome. Our hypothesis was that there will be no impact of weightbearing protocol on outcomes.

Table 1. Patient Demographics and Characteristics (N = 387).

Characteristic	Value
Age, y, mean ± SD	55.2 ± 11.7
Gender, n (%)	
Female	256 (66.1)
Male	131 (72.6)
Race, n (%)	
Caucasian	283 (73.1)
Black	79 (20.4)
Asian	5 (1.3)
Native Hawaiian or Pacific Islander	1 (0.2)
American Indian or Alaskan Native	2 (0.5)
Other	6 (1.6)
Not reported	11 (2.8)
Diabetes, n (%)	68 (17.6)
BMI, mean ± SD	34.8 ± 7.0
Smoking status, n	
Current	11 (2.8)
Passive	3 (0.8)
Quit	106 (27.4)
Never	267 (69.0)

Abbreviation: BMI, body mass index.

Methods

Patient Selection

Following institutional approval, a retrospective review of all open surgical management for Haglund syndrome between January 2015 and December 2023 was completed. All procedures were performed by one of 6 fellowship-trained foot and ankle orthopaedic surgeons. Patients were included based on the diagnosis of Haglund deformity, retrocalcaneal bursitis, or insertional Achilles tendinopathy with *Current Procedural Terminology* (*CPT*) codes 27654, 28118, and 28120, which are associated with a Haglund resection. Additionally, concurrent operative management of other foot pathologies, including heel ulcers, calcaneus fractures, bony fusions, or hardware removal in the forefoot, midfoot, or hindfoot, was excluded after complete *CPT* codes were reviewed (Table 1; Figure 1). Treatment technique was at the discretion of the orthopaedic provider. Of note, all providers maintained the same technique in all of their respective patient populations. There was a gradual return to weightbearing in each surgeon's respective cohort. This cohort of patients was reviewed for the following variables: age, sex, body mass index (BMI), smoking status (never, quit, active), American Society of Anesthesiologists Physical Status Classification (ASA), date of surgery, type of repair (corkscrew [CS], speed bridge [SB], suture anchor [SA]), initial postoperative weightbearing recommendations (full weightbearing, partial weightbearing [PWB], touchdown weightbearing [TDWB], and nonweightbearing [NWB]), postoperative outcomes (Achilles rupture, wound breakdown/infection, persistent pain after the 6-week time point, debilitating plantarflexion weakness, revision), and date of most recent follow-up. Debilitating weakness was defined at the 6-month mark with an inability to plantarflex against body weight outside of the walking boot. Wound breakdown was described if it was mentioned in the provider notes of the patient's electronic medical record.

Statistical Analysis

Descriptive statistics calculated the mean, standard deviation, and frequencies. Chi-square test was used to compare categorical variables such as smoking status, diabetes status, gender, and categorical outcomes including complications, rupture, revision surgery, and pain. Age and BMI

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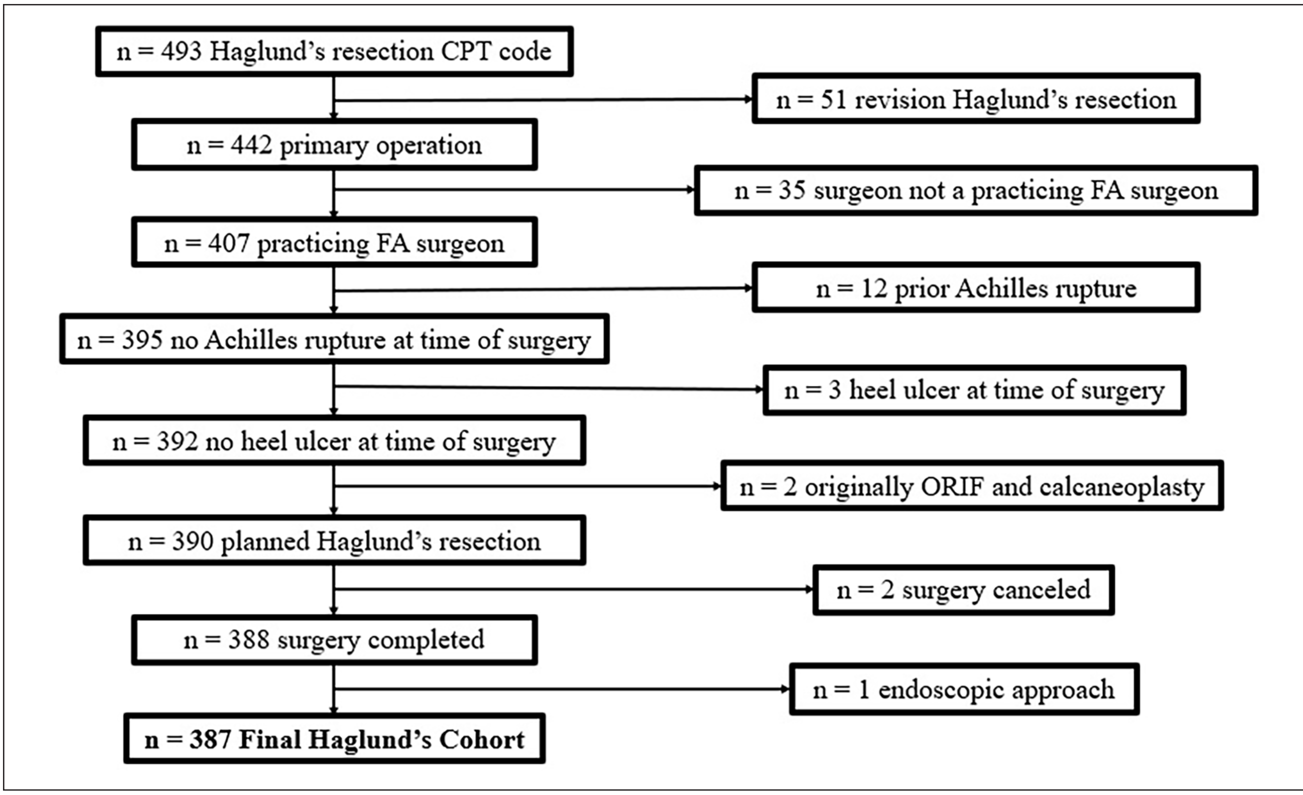

Figure 1. Exclusion criteria for study population.

were compared using analysis of variance. Normality was visually assessed using plots. Statistical analyses were performed using R, version 3.6.1 (R Foundation, Vienna, Austria), with statistical significance defined as $P < .05$. An initial power analysis was conducted to assess the sample size. For the primary outcome of interest—complication rates (e.g., persistent pain, wound breakdown, rupture)—the analysis aimed to achieve a power of 0.80 (80%) with a significance level of $\alpha = .05$. Based on the complication rates observed in the literature, the effect size was estimated to be medium (Cohen $h = 0.50$). The sample size calculation for comparing proportions indicated that a minimum of approximately 100 patients per weightbearing group would be necessary to detect a medium effect size with the specified power and significance level. Given the study's total sample size of 387 patients, distributed across 4 weightbearing protocol groups, the analysis provided adequate power to detect moderate to large differences in outcomes

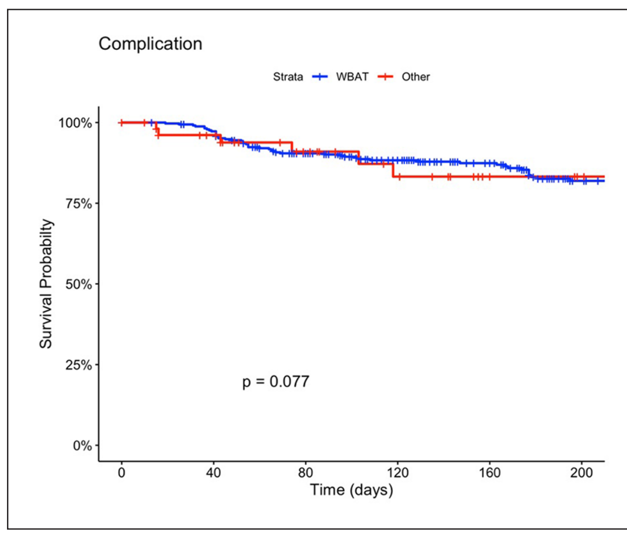

Figure 2. Survival analysis by weightbearing regimen.

Results

Study Demographics

The study cohort comprised 387 patients (256 females, 131 males), with an average age of 55.2 ± 11.7 years and an average BMI of 34.8 ± 7.0 (Figures 2 and 3). The follow-up time ranged from 0 to 2626 days. Follow-up was right skewed with a mean of 307 days and median of 174 days. There were 68 patients (17.6%) with a history of diabetes. The most common postoperative weightbearing protocol was NWB (n = 268; 69.3%), TDWB (n = 56; 14.5%), weightbearing as tolerated (WBAT; n = 54; 14.0%), and PWB (n = 9; 2.3%). There were no significant differences in preoperative characteristics including age, diabetes, gender, BMI, and smoking status between the different weightbearing protocol groups. Patients assigned to PWB had the youngest average age of 52.9 ± 15.3 years, whereas those assigned to TDWB had the oldest average age of 58.0 ± 11.0 years. However, these age differences were not statistically significant.

Complications

The overall complication rate of various complications was as follows: persistent pain (n=40; 10.3%), wound breakdown/infection (n=33; 8.5%), weakness (n=6; 1.6%), and postoperative rupture (n=1; 0.3%). Revision surgery occurred in 1.8% of the population (n=7). There were no statistically significant differences in complication rate between the different weightbearing protocol groups (*P*=.48354; Table 2). The date of complications ranged from 15 to 2084 days postoperatively, with a mean of 214 and median of 102 days.

The WBAT group experienced the highest rate of pain (14.8%) whereas the PWB group had the lowest rate of pain (0.0%), although these differences were not statistically significant. Similarly, there was a non–statistically significant higher rate of the need for revision surgery in the WBAT group (3.7%). The highest rate of wound breakdown/infection occurred in the NWB group (9.7%). The one patient who experienced a rupture was in the WBAT protocol group.

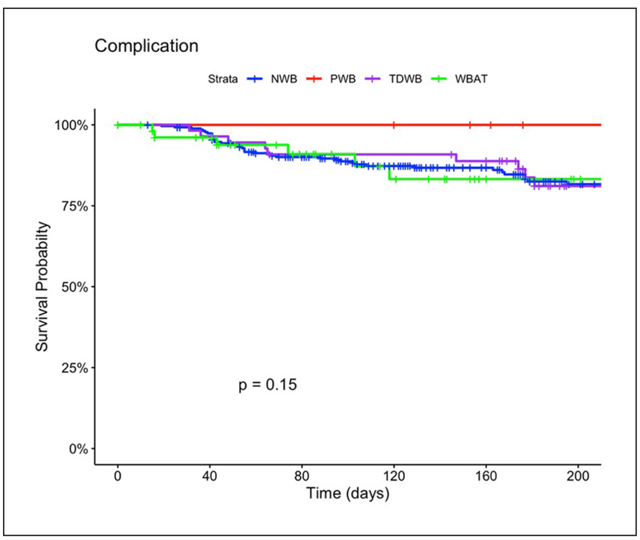

Figure 3. Survival analysis for entire cohort.

Discussion

There were no differences in outcomes of interest (debilitating plantar flexion weakness, Achilles rupture, wound breakdown/infection, and persistent pain) based on postoperative weightbearing protocol in this cohort. Additionally, there were no significant differences between the preoperative comorbidity characteristics between groups. To our knowledge, this is the first study to assess the role of different rehabilitation protocols and their effect on outcomes following open surgical management for Haglund syndrome at such a large scale. Consequently, contextualizing these findings proves challenging given the scarcity of related research.

Despite multiple modes of conservative management (shoe modifications, physical therapy, orthoses, eccentric strengthening, and nonsteroidal antiinflammatory medications, etc),[4,5] symptomatic patients often require operative intervention with Haglund deformity removal and Achilles repair.[10,24] Authors at this institution all use open approaches as opposed to endoscopic. The broad spectrum of postoperative weightbearing protocol differs greatly between surgeons at our institution. Haglund rehabilitation techniques in the literature also differ greatly from immediate WBAT in CAM boot ± heel wedges POD1 (endoscopic),[16] NWB in splint × 5-7 days (endoscopic),[16] NWB in splint × 2 weeks (open),[4,7,17,22] NWB × 3 weeks, but only in splint for 2 weeks (open),[13] NWB in cast × 6 weeks (open).[21] Discrepancies may be influenced by factors such as patient surgical approach, the extent of diseased Achilles requiring debridement, and the need for FHL transfer.[7,20] In this study, we elected to exclude patients with FHL transfer to minimize confounders for this analysis. Additionally, we do not complete endoscopic Haglund surgery at our institution. Therefore, the only modifications in the postoperative protocol are based on the nature of the operative findings of Achilles integrity and repair type. Of note, only 2 of the 6

Table 2. Complications by Postoperative Weightbearing Protocol.

Weightbearing Status	Total	Any Complication, n (%)	Pain, n (%)	Wound Breakdown, n (%)	Weakness, n (%)	Rupture, n (%)	Revision, n (%)
Nonweightbearing	268	54 (20.2)	27 (10.1)	26 (9.7)	4 (1.5)	0 (0.0)	5 (1.9)
Touchdown weightbearing	56	12 (21.4)	5 (8.9)	5 (8.9)	2 (3.6)	0 (0.0)	0 (0.0)
Weightbearing as tolerated	54	12 (22.2)	8 (14.8)	1 (1.9)	0 (0.0)	1 (1.9)	2 (3.7)
Partial weightbearing	9	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

providers in this study changed their protocol depending on the patient. The others maintained a strict protocol, regardless of patient or procedure. In a prospective cohort study on the impact of early WB (at the 2-week mark), Arunakul et al[3] found that the accelerated group (n=31) initially outperformed the conventional group (n=18) at 3 months regarding functional outcomes (visual analog scale, Foot and Ankle Ability Measure, and the 36-Item Short Form Health Survey). However, they report that functional outcomes were both improved at the 6-month and 1-year marks, but not significantly different from one another.

A recent systematic review found that the overall complication rate associated with open surgery for Haglund deformity was 12.3%. However, this rate varied significantly across included studies (0%-53%) and likely attributed to inclusion of concurrent procedures, small cohort sizes, and variation in surgical technique.[26] In a large series of 432 patients who underwent surgical treatment of Achilles overuse injuries, Paavola et al[18] demonstrated a complication rate of 11%. Despite our populations having similar magnitude, the composition of the patient population was not comparable (inclusion of Achilles ruptures, anomalous soleus, xanthoma patients) and the length of follow-up was unclear (5-month minimum for all patients, and at least 1 year for all patients with a complication). Furthermore, postoperative debilitating weakness in plantarflexion and ongoing pain within their patient cohort was not explicitly assessed.[18] Therefore, the reported complication rates in this manuscript are not necessarily comparable to their study and may provide a more comprehensive assessment of outcomes in a larger and more heterogenous cohort. Literature on complications in this patient population have cited gender as impactful on patient outcome with a greater incidence of complications in women.[23] We did not find this pattern within our larger cohort. The most common complication within our study was persistent pain (10.3%). Unfortunately, validated patient-reported outcome measures, range of motion, and strength assessments were not available within our patient population in a manner that would allow for more granular analysis. The second most prevalent complication was wound breakdown or infection (8.5%). In a systematic review, Yuen et al[26] described wound complication rates anywhere from 0% to 11%.

The WBAT cohort had the highest frequency of postoperative pain at nearly one-sixth of the group and a higher rate of revision surgery at 3.7%. Potential etiology for increased pain and revision in the WBAT group could relate to range of motion and weightbearing earlier than tolerable in the setting of healing soft tissue insult. However, there was no statistically significant difference in pain or revision rates between groups. Thus, the choice of rehabilitation protocol is left to the discretion of the individual surgeon in accordance with the patient's needs and preferences. In a similar, though distinctly different, pathology, impact of postoperative weightbearing has been reviewed in the Achilles rupture population. Suchak et al[25] evaluated a series of 110 patients who underwent operative management of an Achilles rupture and found that patients who began weightbearing at 2 weeks had better 6-week quality of life performance than those who were maintained nonweightbearing for a total of 6 weeks. Six-month analysis of the cohorts demonstrated no difference in outcome between groups. Nonetheless, further prospective investigation into the interplay between early weightbearing, tissue healing kinetics, and postoperative outcomes is warranted to elucidate the optimal rehabilitation strategies following surgical management of Haglund syndrome.

Limitations of this study include the retrospective design and insufficient information on WB assignment, academic setting, and the lack of patient-reported outcome measures. Although this study is retrospective in nature, treating providers maintained the same operative and postoperative treatment regimens, which does not negate, but does decrease some of the selection bias. The academic setting of this study precludes the findings from being widely generalizable. However, we believe that inclusion of 6 different fellowship-trained foot and ankle surgeons and the size of our cohort improves the heterogeneity of the study. The unequal size of each of the assignments for WB status could lead to imprecision with comparisons of groups, limiting generalizability further. For example, we had 269 patients assigned to NWB and 9 to PWB. In this study, selection bias is an inherent limitation, as patients with better tissue integrity or a lower risk for complications may have been preferentially assigned to more aggressive rehabilitation protocols such as WBAT. This may explain why, despite the lack of statistically significant differences in outcomes between weightbearing groups, subtle differences in patient characteristics, such as tissue or bone quality, may have influenced rehabilitation assignments and ultimately masked potential differences in outcomes. Addressing this limitation in future studies with prospective designs and randomization of rehabilitation protocols will be critical to better understanding the true impact of postoperative weightbearing protocols on patient outcomes. One final, significant limitation of this study is the potential for Type II error, which occurs when a true effect is not detected because of insufficient statistical power. Although our sample size of 387 patients was calculated to provide adequate power for detecting moderate to large differences in complication rates, it is possible that the study was underpowered to detect smaller, yet clinically relevant, differences between weightbearing protocols, or to handle the problem of very different group sizes (eg, 269 vs 9). Although our study suggested that there were no statistically significant differences in outcomes across the different weightbearing protocols, it does not rule out the possibility that clinically important effects might exist and could be identified with a larger study with more balanced group sizes.

Conclusion

This large retrospective study regarding surgical treatment for Haglund syndrome with average follow-up of 10.1 months demonstrates that we did not identify significant differences in postoperative complication rates—Achilles rupture, wound breakdown/infection, persistent pain, or plantarflexion weakness—across weightbearing protocols. The most common complication was persistent pain (10.3%), followed by wound breakdown or infection (8.5%), and revision surgery was required in 1.8% of cases.

The lack of significant variation in outcomes suggests that weightbearing protocols can be tailored to individual patient needs and preferences without compromising safety or efficacy. This flexibility may allow surgeons to optimize patient comfort and autonomy in postoperative care, adapting protocols according to each patient's healing progress, pain tolerance, and functional requirements.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Albert T. Anastasio, MD, reports disclosures from Qpix Solutions. Andrew E. Hanselman, MD, reports disclosures from American Orthopaedic Foot & Ankle Society: board or committee member; Artelon: paid consultant; Arthrex, Inc: paid consultant. Karl M. Schweitzer, MD, reports disclosures from Ibex Inc, restor3d Inc, Stryker, Ibex Inc, and Tayco Brace, Inc: stock option. Samuel B. Adams, MD, reports disclosures from American Orthopaedic Foot & Ankle Society: board or committee member; Conventus/Flower: paid consultant; DJ Orthopaedics: intellectual property (IP) royalties, paid consultant; Exactech, Inc: paid consultant; Medshape: stock or stock options; Orthofix, Inc, Regeneration Technologies, Inc, and Stryker: paid consultant. Mark E. Easley, MD, reports Exactech, Inc: IP royalties, paid consultant, paid presenter or speaker, research support; IFFAS: board or committee member; *Journal of Bone and Joint Surgery–American*: editorial or governing board; Paragon28: paid consultant, paid presenter or speaker; Saunders/Mosby-Elsevier: publishing royalties, financial or material support; Springer: publishing royalties, financial or material support; Treace Medical: IP royalties, paid consultant, paid presenter or speaker; Wolters Kluwer Health–Lippincott Williams & Wilkins: publishing royalties, financial or material support. James A. Nunley, MD, reports disclosures from Bristol-Myers Squibb: stock or stock options; DTMedTech: research support; Exactech, Inc: IP royalties, paid consultant; Springer, Datatrace: publishing royalties, financial or material support; Treace Medical and Trimed: paid presenter or speaker. Annunziato Amendola, MD, reports disclosures from the *American Journal of Sports Medicine*: editorial or governing board; Arthrex Inc: IP royalties; Bone Solutions Inc and Miach Orthopedics Inc: stock or stock options; *Journal of ISAKOS*: editorial or governing board; Springer: publishing royalties, financial or material support; Stryker: research support; Wolters Kluwer Health–Lippincott Williams & Wilkins: publishing royalties, financial or material support. Disclosure forms for all authors are available online.

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