THE COST OF ROUTINE CLINIC VISITS FOLLOWING SPINAL FUSION FOR ADOLESCENT IDIOPATHIC SCOLIOSIS

Michael Orness, MD[1]; Lori A. Dolan, PhD[1]; Stuart L. Weinstein, MD[1]

ABSTRACT

Background: The institutional standard follow-up schedule for patients undergoing spinal instrumentation and fusion for adolescent idiopathic scoliosis (AIS) is return to clinic at 6-weeks and 3 months post-procedure for radiographs. COVID-19 prompted a change in this practice and most routine post-op visits were performed virtually during that time. The purpose of this study is to estimate the cost and benefit of in-person visits to inform the relative value of in-person follow-up using data from the year prior to COVID changes.

Methods: This was a retrospective study including all patients with AIS who underwent spinal instrumentation and fusion in 2019 by a single surgeon at a tertiary medical center. The cost of radiographs, travel, and parental lost wages associated with follow-up visits at 6-weeks and 3-months were estimated. Transportation costs were estimated by multiplying the distance between home and clinic by the standard IRS travel reimbursement rate ($0.58/mile). Parental lost wages were estimated using the average 2019 US census income for men and women. Each patient's electronic medical record was reviewed to see whether radiographs and physical assessment resulted in any changes in orthopaedic management at each visit.

Results: The sample included 63 patients (75% female, 94% Caucasian) with an average age of 15.22 years. The average round-trip distance traveled was 94.4 miles (range 3.2-476), resulting in an average travel cost of $109.47. The total time spent for a visit (travel, wayfinding and the clinic visit itself) averaged 330 minutes, resulting in an estimated lost parental wage of $125.47. Estimated cost of radiographs at each visit was $693. This combined cost burden totaled $927.94 for each visit, and no changes in management were prompted by clinical or radiographic findings at any of the 126 visits.

Conclusion: COVID-19 presented many new challenges to healthcare, including a necessary increase in virtual healthcare delivery. This study estimated the cost of in-person follow-up visits the year prior to COVID-19. Patients and their families traveled hundreds of miles and spent hundreds of dollars to attend these visits. No changes in clinical management were prompted by findings at these in-person follow-up visits, and implementation of virtual post-operative visits could potentially lead to cost savings for families in these instances.

Level of Evidence: III

Keywords: scoliosis, cost, COVID-19, follow-up

INTRODUCTION

COVID-19 created many new challenges across the healthcare field. Access to clinic visits was made very difficult throughout the country and many visits were performed virtually.[1] Multiple studies have investigated the efficacy of virtual visits throughout multiple orthopaedic subspecialties.[2-4]

Healthcare costs in the United States surpassed $3.0 trillion in 2014 and have continued to trend upward.[5,6] Previous studies have estimated the cost of post-operative visits in a variety of orthopaedic subspecialties.[7,8] Post-operative visits may not pose a large cost burden to the healthcare system, but they may pose a significant cost to patients and families.[7] There is emerging evidence regarding the cost-effectiveness of virtual clinic visits in orthopaedics and other surgical subspecialties, which could potentially decrease costs to patients.[2,3,9,10] Additionally, other studies investigating routine post-operative orthopedic visits have shown that management does not routinely change following these appointments.[11,12] To our knowledge, no previous investigations have quantified the cost of routine post-operative clinic visits and radiographs for AIS patients following spinal fusion.

Prior to COVID-19 shutdowns, the standard follow-up visits at our institution for patients undergoing spinal fusion for adolescent idiopathic scoliosis (AIS) was 6 weeks, 3 months, 6 months, and 1 year, and radiographs

[1]Department of Orthopedics and Rehabilitation, University of Iowa Hospitals and Clinics, Iowa City, Iowa, USA

Corresponding Author: Michael Orness, MD, michael-orness@uiowa.edu

Disclosures: The authors report no potential conflicts of interest related to this study.

Sources of Funding: No sources of funding declared.

were obtained each of these visits. The purpose of this study is to determine the value of the 6-week and 3-month post-operative clinic visits by estimating the costs to families and assessing the clinical necessity of these in-person visits.

METHODS

Patient Sample

This retrospective review included all patients with the diagnosis of AIS who underwent spinal instrumentation and fusion by a single orthopedic surgeon (SLW) at a tertiary care center in 2019. Patients with the diagnosis of neuromuscular, congenital, or other non-idiopathic scoliosis were excluded. Demographic data (age, sex, race, body mass index (BMI), home address) and clinical data (results of clinical and radiographic examinations, new prescriptions, orders for additional testing or referrals, and return to the operating room or change in routine post-operative patient instructions) were abstracted from the electronic medical record (EMR) for each patient.

Cost Accounting

We adapted the methodology and estimates from a previous cost-estimation study at our institution for AIS.[13] Meirick et al. determined the costs of unnecessary referrals for AIS evaluation to our institution in 2013-2014.[13]

Transportation

Travel cost was estimated by calculating the total number of miles driven from each patient's home address to the clinic using an online distance calculating program via Google Maps. If the patient's street address was not included in the program, the center of the hometown was used to calculate distance traveled. Distance was then multiplied by the standard business mileage rate ($0.58 per mile) from the Internal Revenue Service (IRS) for the year 2019.[14] This per mile rate reflects the combination of fixed and variable costs for vehicle operation.

Parental/Patient Lost Wages

The presence of the mother, father, or both parents at the clinic was determined by review of the clinic note for each visit. If the patient was older than 22 years of age (n=3), their wages were also included. The average salary according to US Census Bureau 2019 estimates was $67,123 and $52,035 for men and women, respectively. Salaries were then divided by 2087 hours to estimate an hourly wage for each parent.[15] We used the wayfinding time (navigating from the parking lot to the clinic) and clinic visit duration estimates reported by Meirick et al.[13] Lost wages were then estimated by adding the round-trip travel time, wayfinding time,[13] and average clinic visit duration, and multiplying the sum by the estimated hourly wage.

Post-operative Clinical Follow-ups

The standard post-operative protocol for AIS patients includes return to clinic at 6 weeks and 3 months for standing anteroposterior and lateral full spine films with direct clinical examination of the patient. Clinic notes were reviewed for the presence of any complications resulting in the need for antibiotics or other medications, additional testing, or referral, return to the operating room, or a change to the standard post-operative protocol. We specifically looked for complications that were found via direct physical examination and/or radiographs.

RESULTS

Sample Characteristics

Sixty-three patients met the inclusion criteria. Their mean age at surgery was 15.22 ± 2.9 years and 47 (75%) were female. The racial breakdown was representative of the institution's catchment area (94% white, 5% Hispanic, 1% African American). The average BMI was 22.2 ± 6.4 (range: 13.9-43.8).

Transportation and Clinical Costs

The average round-trip travel distance for follow-up appointments was 188.74 ± 114.78 miles (range: 3.2-476). This resulted in an average cost of $109.47 ± $66.57 (range: $3.20-$476.00). A total of 126 scoliosis films were obtained during the 126 clinic visits. The estimated cost per film was $693.

Parental/Patient Lost Wages

The estimated round-trip travel time was 184.44 ± 104.65 minutes (range: 12-442). Meirick et al.[13] estimated average wayfinding time at 6.4 ±1 2.0 minutes and time in clinic at 128.4 ± 12.0 minutes. Of the 126 visits, both parents were present at 24%, the mother only at 35%, and the father only at 3%. Multiplying the estimated travel time by the appropriate salary figures resulted in estimated parental/patient lost wages of $125.47 ± $90.37 (range: $0.00-$407.56).

Total Cost and Clinical Findings

The estimated cost of each visit was $927.94 ± $156.94 (range: $694.86-1376.64). The clinical examinations were all within normal limits for the stage of recovery. The radiographs did not reveal any cases of instrumentation failure. No new medications or changes in the standard post-operative management were recommended based on the physical examination or radiographs obtained at any of these visits.

DISCUSSION

In this study, in-person 6-week and 3-month post-operative visits did not lead to any changes in standard management. On average, patients traveled a total of 188 miles and faced an estimated loss of $927.94 for each follow-up visit. Given the absence of changes in clinical management, this raises the question of whether these in-person follow up visits are worth the cost to each family.

There is no current consensus on when standard post-operative visits for patients undergoing spinal fusion for AIS should occur or when radiographs should be obtained. Garg et al. investigated the frequency with which radiographs were obtained during the first year after spinal fusion for patients with AIS.[16] They found an average of 6 radiographs were obtained during the first post-operative year, and implant failure was found in 2% of their patients. Additionally, they reported increased pain as the only clinical finding associated with implant failure. Similarly, Garcia et al., found only 0.6% of post-operative films demonstrated an abnormal finding.[17] and, only 0.17% of radiographs in addition to clinical findings led to revision procedures. These studies suggest that standard post-operative films may not be necessary if pain is absent and clinical exam is benign.

While there is no evidence reporting the cost of follow-up visits following spinal fusion for AIS, cost estimates of follow-up visits in other orthopaedic subspecialties do exist. Hendricks et al. estimated the cost of total joint arthroplasty follow-ups visits to average $135.20,[8] and that 84% of patients felt these follow-up visits were necessary. Predmore et al. surveyed patients regarding their preference of in-person versus virtual clinic visits and found that 53% of patients preferred in-person visits, while 21% of patients preferred video visits.[18] This supports a growing body of evidence that in-person post-operative visits may not be necessary if patients are not having pain or other concerning symptoms.

To our knowledge, this is the first investigation quantifying patient cost-burden at post-operative follow-up visits after spinal fusion for AIS. This study demonstrates high estimated costs of roughly $927 per visit or $1,854 for both visits at the 6-week and 3-month post-operative time points. Given the high financial burden this may pose to some families, it may be reasonable to offer patients the option of a phone call or telehealth visit in the absence of pain or other abnormal symptoms. Our study did not identify any signs of radiographic hardware failure at these time points and suggests that these visits are unlikely to result in any changes to clinical management. We believe further investigation is warranted to discern whether AIS patients and their families may prefer the option of a virtual visit in lieu of an in-person appointment at the early postoperative time points following spinal fusion. Given these data, we believe it would be safe to offer a virtual visit at the 3- and 6-week post-procedure time points depending on patient preferences.

REFERENCES

1. **Vaccaro, A.R., et al.** Practice Management During the COVID-19 Pandemic. J Am Acad Orthop Surg, 2020. 28(11): p. 464-470.
2. **Arvidsson, L., et al.** Virtual Follow up After Distal Radius Fracture Surgery-Patient Experiences During the COVID-19 Pandemic. J Patient Exp, 2023. 10: p. 23743735231188819.
3. **Waite, E. and Z. Ahmed.** How safe and effective are paediatric virtual fracture clinics? A systematic review. Front Digit Health, 2023. 5: p. 1261035.
4. **Mansukhani, S.A., et al.** Remote Follow-up of Shoulder Arthroplasty Patients During COVID-19 Pandemic - Is This the way Forward? J Shoulder Elb Arthroplast, 2022. 6: p. 24715492221075460.
5. **Ning, N., A. Haynes, and J. Romley.** Trends in the quality and cost of inpatient surgical procedures in the United States, 2002-2015. PLoS One, 2021. 16(11): p. e0259011.
6. **Keehan, S.P., et al.** National health spending projections through 2020: economic recovery and reform drive faster spending growth. Health Aff (Millwood), 2011. 30(8): p. 1594-605.
7. **Hendricks, T.J., A.C.M. Chong, and R.P. Cusick.** The Cost of Routine Follow-Up in Total Joint Arthroplasty and the Influence of These Visits on Treatment Plans. Kans J Med, 2018. 11(3): p. 59-66.
8. **Gilmartin, N.F., et al.** Costs associated with potentially unnecessary postoperative healthcare encounters after lumbar spine surgery. Spine J, 2022. 22(2): p. 265-271.
9. **Paquette, S. and J.C. Lin.** Outpatient Telemedicine Program in Vascular Surgery Reduces Patient Travel Time, Cost, and Environmental Pollutant Emissions. Ann Vasc Surg, 2019. 59: p. 167-172.
10. **Joseph, V., M.T. Nagy, and J. Fountain.** Cost analysis on virtual clinic follow-up after primary joint arthroplasty. J Clin Orthop Trauma, 2021. 19: p. 89-93.
11. **Kuorikoski, J.M. and T.P. Söderlund.** Evaluation of a routine follow-up visit after an internal fixation of proximal femoral fracture. Injury, 2017. 48(2): p. 432-435.
12. **Kraft, D.B., et al.** Minimally Displaced Lateral Humeral Condyle Fractures: Optimizing Follow-up and Minimizing Cost. J Pediatr Orthop, 2023. 43(1): p. 1-6.
13. **Meirick, T., et al.** Determining the Prevalence and

Costs of Unnecessary Referrals in Adolescent Idiopathic Scoliosis. Iowa Orthop J, 2019. 39(1): p. 57-61.
14. IRS, Internal Revenue Service. Standard Mileage Rates. Available at: https://www.irs.gov/tax-professionals/standard-mileage-rates.
15. Computing hourly rates of pay using the 2,087-Hour Divisor. United States Office of Personnel Management. Available at: https://www.opm.gov/policy-data-oversight/pay-leave/pay-administration/fact-sheets/computing-hourly-rates-of-pay-using-the-2087-hour-divisor/.
16. **Garg, S., et al.** Are routine postoperative radiographs necessary during the first year after posterior spinal fusion for idiopathic scoliosis? A retrospective cohort analysis of implant failure and surgery revision rates. J Pediatr Orthop, 2015. 35(1): p. 33-8.
17. **Garcia, G.H., et al.** Do routine radiographs within the first two years following pediatric posterior spinal fusion prompt revision surgery? Spine (Phila Pa 1976), 2013. 38(25): p. 2216-20.
18. **Predmore, A.S., Roth, E.,Breslau, J., et al.** Assessment of patient preferences for telehealth in post-COVID-19 pandemic health care. JAMA Netw Open 2021. Dec 1;4(12):e2136405.