

Cortisone or Gel? A Prospective Cost-Effectiveness Comparison of Injections for Knee Osteoarthritis

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INTRODUCTION: Nearly half of the U.S. population will experience some form of knee osteoarthritis during their lifetime, with almost 50% of patients opting for intra-articular knee injections before total knee replacements. However, there is no established consensus on whether corticosteroids (CS) or intermediate molecular weight hyaluronic acid (IMW-HA) provides greater value. This study aims to evaluate the value of each injection type using cost and patient-reported outcomes, hypothesizing that CS injections will offer greater value compared to IMW-HA.

METHODS:

Patients undergoing CS and IMW-HA injections were recruited from a Midwestern, tertiary-care academic health center. Total costs were categorized into the following groups:

Direct Labor (DL): Average per-minute personnel cost

Direct Supply (DS): Equipment used during visit

Direct Fixed (DF): Maintenance and utilities

Indirect: Marketing, administration

Using time-driven activity-based costing (TDABC), process maps outlining the steps that a patient takes from check-in until discharge were created. Time utilized by personnel at each step was used to determine DL costs. DS costs were calculated using activity-based costing (ABC). DF and indirect costs were calculated using claims-based technical fee data, using a proportion calculated by our institution's allocation of technical fee reimbursement, validated by data comparison of over 4000 orthopaedic surgeries.

Patient reported outcomes (PROM) were measured using Patient Reported Outcomes Measurement Information System Pain Interference (PROMIS PI), Physical Function (PROMIS PF), and Knee injury and Osteoarthritis Outcome Score – Joint Replacement (KOOS-JR). Differences between pre- and post-injection PROMIS PI, PROMIS PF, and KOOS scores at 3-months were multiplied by the average length of effectiveness of each injection type for each patient to calculate PROMIS and KOOS adjusted life years for each type of injection (QALYPI, QALYPF, QALYK). A positive value for any of these QALYs indicates an improvement in that measurement.

Total costs were divided by QALYPI, QALYPF, or QALYK to calculate the Value (ValuePI, ValuePF, ValueK) per patient. Cohorts with lower, non-negative, Value are interpreted as more cost-effective than those with greater or negative Value.

RESULTS:

12 patients were recruited for each cohort at this time. On average, IMW-HA total costs were significantly higher than CS (\$270.42 versus \$124.58, $p < 0.0001$). Average DL costs for CS were \$13.41 compared to IMW-HA at \$16.70 ($p = 0.69$). DS costs were also significantly higher for IMW-HA injections compared to CS (\$187.14 versus \$10.61, $p < 0.0001$).

For PROMs, no significant differences were found between the injections for all the surveys. For PROMIS PI, the average pre- and 3-month post-injection difference was 2.42, while the IMW-HA change was 0.92 ($p = 0.53$). Comparing PROMIS PF, the CS difference was 3.67 while IMW-HA was 0.10 ($p = 0.077$). For KOOS, the change in CS was 10.36 while the change in IMW-HA was 0.014 ($p = 0.13$).

When accounting for adjusted life-years, there were still no significant differences. CS QALYPI averaged 0.6, while IMW-HA QALYPI averaged 0.23 ($p = 0.53$). CS QALYPF was 1 while IMW-HA QALYPF was 0.03 ($p = 0.08$). CS QALYK 2.59 while IMW-HA QALYK was 0.004 ($p = 0.13$).

Value was calculated by dividing the average total cost of each injection by QALY for each PROM. For CS cohort, ValuePI was 206.21 (\$/QALYPI), ValuePF was 124.58 (\$/QALYPF), and ValueKOOS was 48.09 (\$/QALYK). For IMW-HA cohort, ValuePI was 1,160.69 (\$/QALYPI), ValuePF was 10,816.82 (\$/QALYPF), and ValueKOOS was 76,354.05 (\$/QALYK).

DISCUSSION AND CONCLUSION:

This cost-effectiveness study demonstrated that CS injections have significantly lower costs compared to IMW-HA primarily due to direct supply costs. However, when examining all the studied PROMs for both injections, none of the cohorts demonstrated a significant difference. These results are reflected in the Value calculations which consistently favored CS injections with lower values across all outcome domains. These findings suggest that CS's cost-effectiveness is derived from its lower costs.

One limitation to our study is that while current literature maintains that 3 months is the average length of effectiveness for CS and IMW-HA injections, some studies have suggested that these injections may be effective for up to 6 months. Increasing our follow-up time may reflect true outcomes. These results support our hypothesis and suggest that corticosteroids may be the more cost-effective choice.

Though more research is needed, these findings provide an important foundation for incorporating value-based decision-making into orthopaedic care.

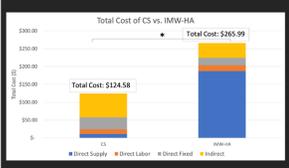


Figure 1. Bar graph comparing average total cost between CS and IMW-HA, stratified by individual costs, factored into the calculation of the total.

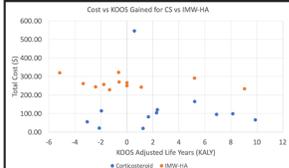


Figure 4. Scatterplot of the total cost of care versus QALY₃ gained at 3 months post-injection. Data points lower and to the right of the scatterplot indicate greater value. N= 12 for CS and n = 12 for IMW-HA.

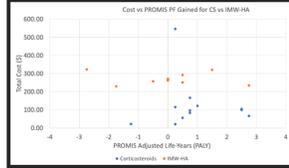


Figure 3. Scatterplot of the total cost of care versus QALY₃ gained at 3 months post-injection. Data points lower and to the right of the scatterplot indicate greater value. N= 12 for CS and n = 12 for IMW-HA.

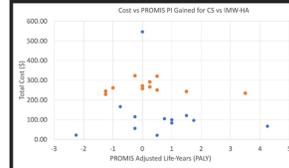


Figure 2. Scatterplot of the total cost of care versus QALY₃ gained at 3 months post-injection. Data points lower and to the right of the scatterplot indicate greater value. N= 12 for CS and n = 12 for IMW-HA.