ANALYSIS OF REVERSE HYBRID TOTAL HIP REPLACEMENT USING THE CORAIL® FEMORAL COMPONENT IN THE NATIONAL JOINT REGISTRY FOR ENGLAND, WALES, NORTHERN IRELAND AND THE ISLE OF MAN

Jack Mantel, Associate Director HEMA | *DePuy Synthes*
John Leopold, Biostatistician | *DePuy Synthes*

Introduction

National joint registries provide valuable and generalizable information on the revision rates / survivorship of newer and older implants alike. Typically they include large cohorts with contributions from all surgeons, irrespective of experience level. The National Joint Registry for England, Wales, Northern Ireland and the Isle of Man (NJR) has been in operation since 2003 and in that time has collected data on over 1,000,000 total hip replacements. A reverse hybrid total hip replacement (THR) uses a cemented all-polyethylene acetabular cup and uncemented femoral stem. Up to the end of 2018, reverse hybrid THR accounted for 28,789 procedures on the NJR, with a steady uptake in adoption from just 0.6% in 2003 to 2.9% in 2018.[1]

Lindalen et al[2] analysed 3,963 reverse hybrid THRs recorded on the Norwegian Arthroplasty Registry in a ten year period between 2000 and 2009. In this cohort there were 3,553 (89.7%) implantations of the CORAIL® stem with six different cemented cup systems. The results were then compared with those from the 10 most common cemented implant combinations over the same follow-up period. The authors found no statistical difference in implant survivorship at 5 and 7 years between the reverse hybrid group and the cemented combinations. This was also the case in patients younger than 60 when the survivorship analysis was adjusted for age. In a study based on data from the New Zealand Joint Registry, Hooper et al3 compared the patient time incidence rates (PTIR) across four fixation types. The reverse hybrid cohort demonstrated similar or lower revision rates as compared to cemented, cementless or standard hybrid fixation, although the cohort size was far smaller than the other groups. McNally et al[4] studied survival of the Furlong HA coated femoral stem in combination with a cemented polyethylene cup at 10-11 years and found survivorship of 99% for the stem and 95% for the cup. The AOA NJRR does not report results for reverse hybrid procedures as a class.

The purpose of this analysis is to examine the results of the CORAIL femoral implant when used in reverse hybrid THR. In addition to the publicly available UK NJR reports, data is also available from a Supplier Feedback dataset, downloaded by DePuy Synthes from the UK NJR on 10th September 2019.[5] This additional information provides detailed data on all CORAIL implantations included on the registry. The focus of this commentary is the combination of CORAIL stems with either the ELITE PLUS™ or MARATHON® XLPE all-polyethylene cemented acetabular cups. Sub-analysis has been performed on different head materials and sizes.

Results

In total the dataset records 7,354 cases in which a CORAIL stem has been implanted with an ELITE PLUS cemented cup, and 14,501 cases in which a MARATHON XLPE cemented cup has been used.

The follow up for the ELITE PLUS group extends to 14 years and the PTIR for this group is 0.33 (95% CI 0.28, 0.38). In the MARATHON XLPE group the maximum follow up is 10 years and the PTIR is 0.30 (95% CI 0.26, 0.34). The system allows for multiple reasons for revision to be entered. These are tabulated below in Table 1 and the cumulative incidence rates of the most prevalent reasons for revision have been plotted in Figure 2 for each cup group.

Kaplan-Meier analysis was undertaken to estimate the cumulative revision rate (CRR) with an end point of revision of any component for any cause. Table 2 includes the cumulative revision rate estimates for the overall cohorts, plus the estimates for the different head materials. The cohort sizes are such that reliable estimates are not possible for all the head size/material combinations.

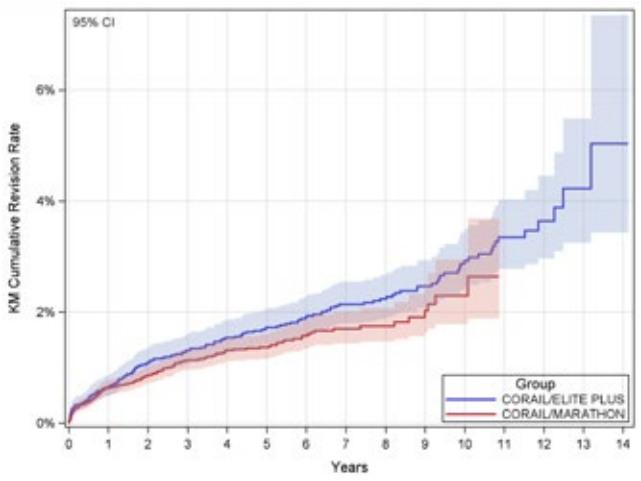

Figure 1:CORAIL Reverse Hybrid THR: Cumulative revision rates split by Cemented Cup (2019 NJR).

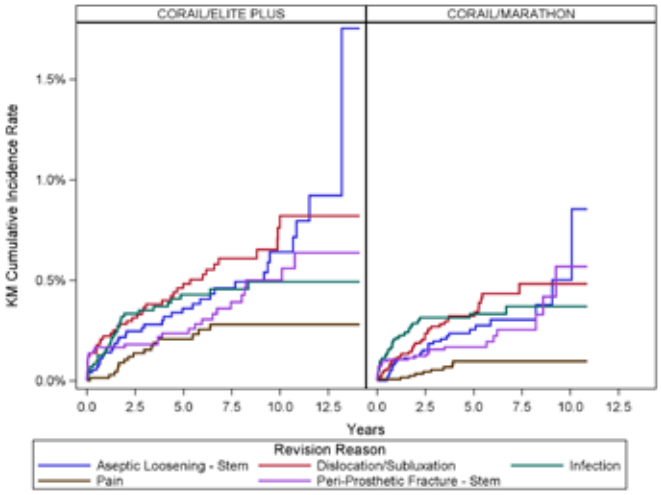

Figure 2: CORAIL Reverse Hybrid THR: Cumulative incidence rate of revision reasons split by Cemented Cup (2019 NJR).

Summary

The National Joint Registry results for the combinations of CORAIL stems with both ELITE PLUS and MARATHON cups compare favourably within the class of reverse hybrid THR as reported on the NJR.[6] The 10-year cumulative revision rate for the CORAIL/MARATHON combination from the Supplier Feedback dataset is 2.29% (95% CI 1.78, 2.94%) This CRR estimate appears to be significantly lower than the class of Reverse Hybrid which has a CRR of 3.83% (95%CI 3.44, 4.27%) at 10 years.[6] The 13-year cumulative revision rate for the CORAIL/ELITE Plus combination is 4.23% (95%CI 3.25, 5.49%) which appears to be equivalent to the class of reverse hybrid at 13 years which has a CRR of 4.80% (95%CI 4.59, 5.03%) at 13 years.

Conclusion

The proponents of reverse hybrid THR claim that the approach is advantageous as it removes the challenges of femoral cementing technique and saves operating time.[7] These advantages can be combined with the excellent long-term results of all-polyethylene cemented cups to provide a long-term solution with excellent survivorship over the mid to long-term.[2,4] The introduction of moderately cross-linked polyethylene may further improve the results of the cemented all-polyethylene cups due to a reduction in wear.[8,9] Cumulative revision rate estimates have been calculated from the NJR dataset on the combination of the CORAIL femoral stem with both the ELITE PLUS and the MARATHON cemented cups. The revision rate estimates of the CORAIL femoral stem with both the ELITE PLUS and the MARATHON cemented cups are low, and compare favourably to the overall class of reverse hybrid THR from the NJR.[6]

Reason	CORAIL/ELITE PLUS		CORAIL/MARATHON	
	Number	Rate	Number	Rate
Dislocation/Subluxation	41	0.56%	42	0.29%
Infection	30	0.41%	44	0.30%
Aseptic Loosening - Stem	35	0.48%	32	0.22%
Peri Prosthetic Fracture - Stem	27	0.37%	27	0.19%
Pain	16	0.22%	9	0.06%
Aseptic Loosening - Socket	2	0.27%	14	0.10%
Malalignment - Stem	8	0.11%	11	0.08%
Wear of Acetabular Component	9	0.12%	3	0.02%
Other	5	0.07%	14	0.10%
Malalignment - Socket	3	0.04%	8	0.06%
Peri-Prosthetic Fracture - Socket	4	0.05%	1	0.01%
Lysis - Stem	2	0.03%	2	0.02%
Adverse Soft Tissue Reaction to Particulate Debris	3	0.04%	2	0.01%
Lysis - Socket	4	0.05%	6	0.04%
Dissociation of Liner	2	0.03%	3	0.02%
Head/Socket Mismatch - Socket	1	0.01%	1	0.01%
Head/Socket Mismatch MDS2	1	0.01%	-	-
Implant Fracture - Stem	1	0.01%	2	0.01%

Table 1: CORAIL Reverse Hybrid THR: Revision reasons split by Cemented Cup (2019 NJR).

Group	1 Year	3 Year	5 Year	10 Year	13 Year
CORAIL/ELITE PLUS n = 7354	0.65% (0.49, 0.87%) n = 6871	1.31% (1.07, 1.61%) n = 5809	1.71% (1.40, 2.09%) n = 3992	2.92% (2.45, 3.50%) n = 1710	4.23% (3.25, 5.49%) n = 138
CORAIL/ELITE PLUS Metal Heads n = 5078	0.64% (0.45, 0.91%) n = 4735	1.08% (0.83, 1.42%) n = 3949	1.48% (1.16, 1.88%) n = 3076	2.79% (2.19, 3.56%) n = 1049	3.77% (2.75, 5.16%) n = 109
CORAIL/ELITE PLUS Ceramic Heads n = 2230	0.69% (0.41, 1.14%) n = 2090	1.79% (1.30, 2.47%) n = 1817	2.26% (1.69, 3.02%) n = 1542	3.25% (2.49, 4.23%) n = 641	n/a
CORAIL/MARATHON n = 14,501	0.63% (0.51, 0.78%) n = 12,788	1.13% (0.95, 1.33%) n = 8615	1.36% (1.16, 1.60%) n = 4912	2.29% (1.78, 2.94%) n = 298	n/a
CORAIL/MARATHON Metal Heads n = 10,052	0.65% (0.51, 0.83%) n = 8801	1.14% (0.93, 1.39%) n = 5729	1.34% (1.10, 1.63%) n = 3245	1.98% (1.54, 2.54%) n = 205	n/a
CORAIL/MARATHON Ceramic Heads n = 4413	0.59% (0.40, 0.87%) n = 3952	1.10% (0.82, 1.49%) n = 2858	1.43% (1.08, 1.89%) n = 1643	2.88% (1.73, 4.76%) n = 87	n/a

Table 2: CORAIL Reverse Hybrid THR: Cumulative revision rate estimates split by Cemented Cup and head material (2019 NJR). (95% CI), N with later follow up.[5]

References

1. National Joint Registry for England, Wales, Northern Ireland and the Isle of Man, 16th Annual Report, 2019, Table 3.4. Available from: www.njrreports.org.uk
2. Lindalen E, Havelin L, Nordsletten L, Dybvik E, Fenstad A, Hallan G, Furnes O, Høvik Ø, Röhrl S. Is reverse hybrid hip replacement the solution? 3,963 primary hip replacements with cemented cup and uncemented stem, from the Norwegian Arthroplasty Register. Acta Orthopaedica 2011; 82 (6): 639-645
3. Hooper GJ, Rothwell AG, Stringer M, Frampton C. Revision following cemented and uncemented primary total hip replacement A Seven-Year Analysis from the New Zealand Joint Registry. J Bone Joint Surg Br. 2009;91(4):451-8
4. McNally SA, Shepperd JAN, Mann CV, Walczak JP. The results at nine to twelve years of the use of a hydroxyapatite-coated femoral stem. J Bone Joint Surg Br. 2000;82(3):378-82.
5. NJR-NJR data from 1st April 2003 -10th September 2019 on DePuy-Synthes products supplied for post-marketing surveillance, NJR Centre, 2019. Notes: NJR-NJR Supplier Feedback data do not include Hospital Episode Statistics (HES) Data Linkage. Revision may therefore be underreported.
6. National Joint Registry for England, Wales, Northern Ireland and the Isle of Man, 16th Annual Report, 2019, Table 3.7. Available from: www.njrreports.org.uk
7. Alho A, Lepistö J, Ylinen P, Paavilainen T. Cemented Lubinus and Furlong total hip endo-prosthesis: a 12-year follow- up study of 175 hips comparing the cementing technique. Arch Orthop Trauma Surg. 2000;120:276-280
8. Engh CA Jr, Hopper RH Jr, Huynh C, Ho H, Sritulanondha S, Engh CA Sr. A prospective, randomized study of cross-linked and non- cross-linked polyethylene for total hip arthroplasty at 10-year follow-up. J Arthroplasty. 2012;27(8 Suppl):2-7.e1.
9. Young-Hoo Kim, Jang-Won Park, Chirag Patel, Dae-Youn Kim. Polyethylene Wear and Osteolysis After Cementless Total Hip Arthroplasty with Alumina-on-Highly Cross-Linked Polyethylene Bearings in Patients Younger Than Thirty Years of Age. J Bone Joint Surg Am. 2013;95:1088-93.

DePuy Synthes *People inspired*™

PART OF THE Johnson&Johnson FAMILY OF COMPANIES

Johnson & Johnson Medical Limited. Baird House, 4 Lower Gilmore Bank, Edinburgh, EH3 9QP, United Kingdom.
Incorporated and registered in Scotland under company number SC132162.

DePuy Orthopaedics, Inc.
700 Orthopaedic Drive
Warsaw, IN 46582
USA
Tel: +1 (800) 366 8143
Fax: +1 (800) 669 2530

DePuy International Ltd
St Anthony's Road
Leeds LS11 8DT
England
Tel: +44 (0)113 270 0461

www.jnjmedicaldevices.com

131602-200203 EMEA