ANALYSIS OF HYBRID TOTAL HIP REPLACEMENT USING THE C-STEM® AMT FEMORAL COMPONENT AND THE PINNACLE® ACETABULAR SYSTEM IN THE NATIONAL JOINT REGISTRY FOR ENGLAND, WALES, NORTHERN IRELAND AND THE ISLE OF MAN

Jack Mantel, BA, Associate Director HEMA | *DePuy Synthes*
John Leopold MS, Biostatistician | *DePuy Synthes Joint Reconstruction*

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 890,000 primary total hip replacements.[1]

A hybrid total hip replacement (THR) uses a cementless modular acetabular cup and a cemented femoral stem. Up to the end of 2016, hybrid THR accounted for 170,589 procedures on the NJR, with a steady uptake in adoption from 12.3% in 2003 to 19.2% in 2016.[1] In 2016, the majority of hybrid THRs utilised a Metal-on-Polyethylene (55.2%)articulation, with smaller proportions for Ceramic-on-Polyethylene (38.1%) and Ceramic-on-Ceramic (6.0%).

The use of Hybrid THR is intended to combine the potential benefits of a cemented stem and a cementless acetabular implant. Development of cementing techniques in the 1970s led to improvements in the durability of cemented femoral components, but even into the 1990s this did not appreciably alleviate the problem of late loosening associated with cemented acetabular cups.[2-3] Cementless fixation on the acetabular side has demonstrated excellent long-term fixation[4-5] and has provided the surgeon with greater flexibility in choice of bearing size and material. It also presents more options when dealing with challenging anatomies or diagnoses.[6]

In a study based on data from the New Zealand Joint Registry, Hooper et al[7] compared the patient time incidence rates (PTIR) across four fixation types. The authors found a lower overall revision rate for hybrid when compared to cementless and the difference was significant ($p<0.01$). Hybrid was also found to have the lowest revision rate in subjects younger than 55 (compared to cemented - $p<0.012$) and in the age range of 55-64 (compared to cementless – $p<0.007$). Good mid- and long-term outcomes in prospective clinical studies are also available elsewhere in the literature.[8-10]

The purpose of this analysis is to examine the results of the hybrid combination of the C-STEM AMT Cemented Stem with the PINNACLE Cementless Acetabular System. In addition to the published NJR reports, data is also made available for post-marketing surveillance from the NJR Supplier Feedback system, downloaded by DePuy Synthes on 10th April 2018.[11] This additional information provides detailed data on all C-STEM AMT implantations included on the registry. Sub-group analysis has been performed on the different PINNACLE bearing options.

Results

In total the dataset records 11028 hybrid THR cases in which a C-STEM AMT Stem had been used with a PINNACLE Acetabular Cup. The mean age of the cohort was 70 years (range 18-98) and there were 6914 females and 4114 males. 90% of cases had osteoarthritis listed as at least one of the primary diagnoses.[11]

The follow-up for the cohort extends to 12 years and the patient time incidence rate (PTIR) is 0.37 (95% CI 0.30, 0.43) revisions per 100 observed component years. A Kaplan-Meier analysis was undertaken to estimate the cumulative revision rate (CRR) with an end point of revision of any component for any cause and the annual estimates are provided in Table 1 with results truncated when fewer than 40 implants remained at risk, as per Lettin et al.[12] Survivorship analysis was also run on the different bearing options, also detailed in Table 2. There were a total of 121 revision procedures recorded and it is noted from the survivorship analysis that only six revisions have taken place after 7 years from a total of 879 subjects at risk.

Group	1 year	2 years	3 years	5 years	7 years	10 years
C-STEM AMT PINNACLE n=11028	0.61% (0.48, 0.78%) n=8521	0.89% (0.72, 1.10%) n=6264	1.12% (0.91, 1.38%) n=4376	1.53% (1.23, 1.89%) n=1968	1.99% (1.55, 2.55%) n=879	2.82% (2.03, 3.91%) n=279
Metal on Poly n=6039	0.68% (0.50, 0.93%) n=4817	0.98% (0.75, 1.29%) n=3609	1.25% (0.96, 1.62%) n=2506	1.64% % (1.24, 2.16%) n=1101	1.91% (1.40, 2.59%) n=443	2.77% (1.66, 4.60%) n=133
Ceramic on Ceramic n=1415	0.43% (0.19, 0.96%) n=1297	0.59% (0.30, 1.18%) n=1162	0.78% (0.42, 1.46%) n=998	1.37% (0.82, 2.29%) n=623	1.82% (1.08, 3.04%) n=324	2.92% (1.71, 4.94%) n=136
Ceramic on Poly n=3508	0.58% (0.37, 0.91%) n=2347	0.88% (0.59, 1.32%) n=1448	1.07% (0.70, 1.62%) n=836	1.23% (0.79, 1.92%) n=226	2.64% (1.20, 5.74%) n=100	n/a

Table 1: C-STEM AMT and PINNACLE Primary THR: Cumulative Revision Rate Estimates by bearing articulation. (2018 NJR) (95% CI), n with later follow up.

Conclusion

Hybrid THR was introduced in order to combine the perceived advantages of cemented femoral stems with the flexibility and long-term durability of cementless acetabular cups.[8-10] The cumulative revision rate estimates calculated from the NJR dataset for the combination of the C-STEM AMT femoral stem and the PINNACLE Acetabular system show satisfactory durability out to ten years, and compare favourably at long term follow-up to the overall class of hybrid THR from the NJR,[13] the Australian Orthopaedic Association National Joint Replacement Registry,[14] and the New Zealand Joint Registry.[15]

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Table HT19: Cumulative Percent Revision of Primary Total Conventional Hip Replacement by Fixation (Primary Diagnosis OA))

Femoral Component	N Revised	N Total	1 yr	3 yrs	5 yrs	7 yrs	10 yrs	13 yrs
Cemented	121	5130	1.4 (1.1, 1.8)	2.1 (1.7, 2.6)	2.7 (2.2, 3.3)	3.7 (2.9, 4.7)		
Cementless	5955	179366	1.7 (1.7, 1.8)	2.6 (2.5, 2.7)	3.3 (3.2, 3.4)	4.9 (4.8, 5.1)	6.9 (6.5, 7.2)	7.0 (6.6, 7.4)
Hybrid	2383	93309	1.2 (1.1, 1.3)	1.9 (1.8, 2.0)	2.5 (2.4, 2.6)	3.9 (3.7, 4.1)	5.8 (5.2, 6.4)	6.0 (5.3, 6.9)
Total	8459	277805						

Note: Includes procedures using ceramic/ceramic and XLPE prostheses

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The data used for this analysis was obtained from the NJR Supplier Feedback System. All analyses of NJR data were undertaken by DePuy Synthes. The Healthcare Quality Improvement Partnership ('HQIP') and the National Joint Registry ('NJR') take no responsibility for the accuracy, currency, reliability and correctness of any data used or referred to in this report, nor for the accuracy, currency, reliability and correctness of links or references to other information sources and disclaims all warranties in relation to such data, links and references to the maximum extent permitted by legislation.

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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

DePuy (Ireland)
Loughbeg
Ringaskiddy
Co. Cork
Ireland
Tel: +353 21 4914 000
Fax: +353 21 4914 199

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