Evans, J. T., & Whitehouse, M. R. (2020). A review of registry research from 2019. *BJ360*, *9*(2). https://doi.org/10.1302/2048-0105.92.360756

BJ360 registry roundup - January 2020

J. T. Evans, M. R. Whitehouse

Musculoskeletal Research Unit, Translational Health Sciences, Bristol Medical School, University of Bristol, Learning and Research Building, Level 1, Southmead Hospital, Bristol BS10 5NB, UK

j.t.evans@bristol.ac.uk

Introduction

Since the launch of the Swedish Knee Arthroplasty Registry in 1975[1] the influence of arthroplasty registry research on trauma and orthopaedic surgery has expanded rapidly. Our own articles using registry data last year, suggested that hip and knee replacements can be expected to last over 25 years[2,3] but linked routine datasets have the potential to answer far more complex questions than simply implant survival. At the time of writing there are 37 members of the International Society of Arthroplasty Registries (ISAR)[4] with the National Joint Registry for England, Wales, Northern Ireland and the Isle of Man (NJR) holding over three million patient records with longest follow-up over 15 years. Whilst a valuable resource, registry data does have its limitations,[5,6] including their observational nature (precluding statements of causality without the use of advanced statistical techniques) and as such struggle to provide one single definitive answer to any research question. Triangulation of evidence and consistency of findings between study modalities are more likely to provide robust answers to important clinical questions, after all there is a known observation effect and difference in patients that choose to take part in clinical trials compared to those who do not. In the future embedding trials within routinely collected data such as registries is likely to become a bastion of orthopaedic research. In this, and subsequent articles we aim to draw attention to a selection of registry-based articles that we believe hold important messages and to highlight their strengths and limitations, as well as offer our own interpretation of their findings on clinical practice. Articles were identified through a date limited search of Medline and Embase using a mix of keywords and MeSH headings on Ovid SP.

Hip

As the available follow-up in registry studies of hip arthroplasty becomes longer, authors have turned their eye to increasing generalisability through collaboration. In the work from Oxford published in April 2019, Ferguson et al. performed a combined analysis of the Geneva and Swedish registries to investigate the influence of American Society of Anaesthesiologists score (ASA) on reoperation in Total Hip Replacement (THR) in the early post-operative period.[7] They observed an adjusted Hazard Ratio (HR) of all-cause revision within 3 months of the primary operation of 2.7 (95% CI 1.2, 5.9) in Geneva and 3.3 (95% CI 2.6, 4.0) in Sweden for patients with an ASA of III-IV compared to those with an ASA of I. This analysis, based on 5,319 and 122,241 THRs from Geneva and Sweden respectively, led them to conclude that targeted risk reduction strategies in patients with ASA III-IV may be appropriate. These findings were consistent with two previous studies from New Zealand and the Netherlands making the results more credible. As the authors point out, ASA is a subjective scoring system, however the "grey area" is more likely to exist between ASA I and II patients and there is more of a stark difference between a patient with ASA of III and above compared to one with an ASA of I. What interventions are available and whether they would make any difference is likely to be beyond the scope of observational data and offers an opportunity for future randomised studies. Given findings were independent of age, sex, BMI, future work to look at reasons for revision and potential causes is also likely warranted.

With recently reported generalisable long-term survival outcomes of THR being greater than many expected, the group of patients most likely to be interested are those falling into the young or very young categories. This particular question was addressed in another collaborative article by Halvorsen et al. using the Nordic Arthroplasty Register Association (NARA) who analysed outcomes of 881 THRs in patients 21 years or younger between 1995 and 2016.[8] These THRs, most commonly implanted for paediatric hip diseases, demonstrated an unadjusted 10-year survival of 86% (95% CI 83, 89) and 15-year survival of 73% (95% CI 68,78). After adjusting for sex, indication, head size and time-period of surgery the authors were unable to demonstrate any difference in survival between

cemented and cementless implants, further putting pay to the myth that younger patients achieve better implant survival from cementless technology.

Knee

NICE guidelines (based heavily on randomised trials rather than observational data) updated in August of 2019 suggest 14 days of aspirin is sufficient VTE prophylaxis following TKR. This recommendation is supported by the recently published work of Hood et al. analysing the Michigan Arthroplasty Registry Collaborative Quality Initiative (MARQUI) database.[9] Their study published in JAMA Surgery suggested that in patients undergoing TKR, treatment with aspirin alone falls within a 30% non-inferiority margin of all other modalities of chemical thromboprophylaxis combined, for the outcomes of both first occurrence of VTE and death. Their cohort of nearly 42,000 patients in a US setting may not be news to a UK audience but is certainly of importance to those practicing TKR in North America.

Patella resurfacing in TKR is a much-discussed subject and Maney et al. attempted to tackle this in their analysis of the New Zealand arthroplasty registry published in JBJS(Am) in March of 2019.[10] They aimed to answer three main questions purporting to whether a surgeon usually, selectively or rarely resurfaces a patella in TKR: who does what, which tactic yields the best survival and which gives the best Oxford Knee Score (OKS) after six months and five years? The analysis of 57,766 primary TKRs performed between 1999 and 2015, unsurprisingly demonstrated the majority (57%) of surgeons had employed selective resurfacing, but more interestingly they also observed that only 7% appeared to "usually resurface". There was no observed difference in overall revision rate (per 100 component years) between groups but "usually" resurfacing appeared to offer higher OKS after both six months and five years. This interesting and well written analysis is however fraught with the challenges of selection bias, low power and sub-group analysis. The authors highlight that selective resurfacing is associated with lower cumulative incidence of revision in posterior stabilised TKR but higher in mobile bearing TKR. What this article does further emphasise is that the decision of whether to resurface or not should rely on a knowledge of which prosthesis is being used and its

characteristics. The debate as to whether re-surfacing of a patella should count as a revision is not addressed by this study and will remain controversial in the UK, particularly amongst those that do not routinely resurface.

Shoulder and Elbow

The shoulder papers that caught our interest over the last year both came from analyses of the Nordic (NARA) database. The first of these articles looked at a comparison of short term (six year) survival between stemmed and stemless shoulder arthroplasty with the second article comparing infection rates between reverse shoulder replacement (RSR) and hemiarthroplasty.[11,12]

The population in Rasmussen et al.'s article in the Journal of Shoulder and Elbow surgery[12] was patients with osteoarthritis (OA) who underwent shoulder replacement between 2011 and 2016 in Denmark, Finland, Norway or Sweden. The intervention was stemless shoulder replacement and comparator was the more frequently implanted stemmed shoulder replacement. The outcome of interest was revision for any indication, defined as the removal or exchange of any component. This cohort study was analysed using Cox proportional hazards modelling with age, sex, previous surgery and time period as co-variates. The authors report no evidence against the null hypothesis that survival between the two groups is the same after six years (HR 1.00 95% CI 0.63, 1.61), however these results should be interpreted with caution. The main reason for this is the inherent selection bias in determination of type of implant to be used. There were differences in the age and sex distribution between groups and whilst a Cox model attempts to control for this, it cannot control for selection bias (a systematic difference between groups). The authors also explain that they did not differentiate between implant brand (which may have an influence on survival) and that the choice of a stemless implant is reliant on bone stock, which reduces the generalisability of the study because not all patients could feasibly have received either intervention. We suggest therefore that the jury is still out regarding equivalence of these two systems and we should wait for further evidence.

The second article authored by Moeini et al.[11] in the Bone and Joint Journal was an analysis of nearly 18,000 shoulders looking at the risk of revision for infection in RSR compared to anatomical TSR or hemiarthroplasty. The population was all patients undergoing replacement within the NARA dataset between 2004 and 2013 with the outcome revision due to infection (defined as removal or exchange of any part of the primary arthroplasty or the addition of a glenoid component to an existing hemiarthroplasty and infection based on "preoperative assessment and perioperative findings"). The authors report increased risk of revision due to infection in RSR compared to anatomical shoulder replacement in both the crude model and the adjusted model for age, sex, indication and year of surgery. The observed effect was greatest in men and younger patients. This analysis is again affected by selection bias as the authors themselves observed that rotator-cuff deficiency is a predictor of revision for infection. This article is certainly food for thought, but with RSR being the bail out option in many patients rather than a choice, implementation of the findings may be variable. Further work on why cuff deficient shoulder are at risk of infection following arthroplasty is certainly warranted.

Registry findings on total elbow arthroplasty (TEA) have, like ankle arthroplasty, been limited by the relatively low numbers. The size of the datasets in comparison to centre case series however is one of the strengths of registries, and further work will arise to give us clues to the future direction of travel in research questions. In their article published in Acta Orthopaedica in August 2019, Viveen et al. reported on 1200 primary total elbow replacements from the Australian Orthopaedic Association National Arthroplasty Replacement Registry (AOANARR) implanted between 2008 and 2018.[13] They observed an almost equal three way split for indication of TEA between trauma, osteoarthritis (OA) and rheumatoid arthritis (RA) overall, but in more recent times (since 2016) trauma and OA are becoming more common whilst RA is decreasing in frequency, likely due to the improved medical management of RA. TEA performed for OA appeared to show a higher revision rate compared to trauma (HR 1.8 95% CI 1.1, 3.0) and RA (HR 2.0 95% CI 1.3, 3.1). Across all cases, the most common reasons for revision were infection (35%) and aseptic loosening (34%); overall unadjusted cumulative percentage revision was 10%, 15% and 19% at three, five and nine years respectively. The authors note that they did not observe any difference in revision estimates between different

prostheses. The take home message from this article is the difference in revision estimates between indications, but as the authors note these are only survival analyses and no PROMs could be included, they were also unable to tell whether TEAs implanted for trauma were performed acutely or as salvage procedures.

Foot and ankle

To date, registry survival studies on total ankle replacement (TAR) have been somewhat limited by the numbers implanted and this year's joint RCS(Eng)/NJR research fellowship was awarded to a trainee intent on overcoming this problem. In their systematic review published in Orthopaedic Clinics of North America, Jeyaeelan et al. attempted to draw a useful line in the sand as to what the registry data tells us to date.[14] Using data up to 2017, the authors compiled 11,567 TARs from the registries of Sweden, Norway, New Zealand, Australia and the UK, with the UK providing the greatest number with 4,687. Five-year survival ranged from 89.6% to 93.1% across these registries with 10-year survival of 69% and 82.8% reported by the Swedish and New Zealand registries respectively. The authors note a 2013 meta-analysis of case-series by Goldberg et al. reporting an 89% 10-year survival, however given the over-estimate of survival in case-series for THR and TKR in our recent articles[2,3] we would recommend taking more attention of registry data compared to case-series subject to reporting bias. The main limitation of any study using registry data to analyse TAR is the small numbers seen within subgroups of particular implants leading to a reduction in power to detect a difference in survival, particularly given a sample size of at least 1600 in each group is recommended.[15] This means that whilst the figures summarising survival in TAR are interesting they provide little information to patients considering operation now.

Conclusion

2019 has proven to be an interesting year for registry research. As the ability and willingness to collaborate between registries increases, we are likely to see larger and more generalisable studies. Some of the challenges with collaborative work, such as implant identification codes and sharing of

pseudo-individualised patient level data are being addressed by the ISAR and we look forward to the results of this work as well as more interesting articles coming from registries around the world.

Acknowledgments

Richard Craig (ST7 Registrar in Trauma & Orthopaedics, HE Thames Valley (Oxford), Honorary Clinical Research Fellow, University of Oxford) for help identifying upper limb articles of clinical relevance.

References

1. Knutson K, Lewold S, Robertsson O, Lidgren L. The Swedish knee arthroplasty register. A nation-wide study of 30,003 knees 1976-1992. *Acta Orthop Scand* 1994; **65**(4): 375-86.
2. Evans JT, Evans JP, Walker RW, Blom AW, Whitehouse MR, Sayers A. How long does a hip replacement last? A systematic review and meta-analysis of case series and national registry reports with more than 15 years of follow-up. *The Lancet* 2019; **393**(10172): 647-54.
3. Evans JT, Walker RW, Evans JP, Blom AW, Sayers A, Whitehouse MR. How long does a knee replacement last? A systematic review and meta-analysis of case series and national registry reports with more than 15 years of follow-up. *The Lancet* 2019; **393**(10172): 655-63.
4. International Society of Arthroplasty Registries. https://www.isarhome.org/members (accessed 15th January 2020).
5. Konan S, Haddad FS. Joint Registries: a Ptolemaic model of data interpretation? *The bone & joint journal* 2013; **95-B**(12): 1585-6.
6. Troelsen A, Haddad FS. The problem is not necessarily the data, it is the interpretation. *Bone Joint J* 2019; **101-B**(10): 1177-8.
7. Ferguson RJ, Silman AJ, Combescure C, et al. ASA class is associated with early revision and reoperation after total hip arthroplasty: an analysis of the Geneva and Swedish Hip Arthroplasty Registries. *Acta Orthop* 2019; **90**(4): 324-30.
8. Halvorsen V, Fenstad AM, Engesaeter LB, et al. Outcome of 881 total hip arthroplasties in 747 patients 21 years or younger: data from the Nordic Arthroplasty Register Association (NARA) 1995-2016. *Acta Orthop* 2019; **90**(4): 331-7.
9. Hood BR, Cowen ME, Zheng HT, Hughes RE, Singal B, Hallstrom BR. Association of Aspirin With Prevention of Venous Thromboembolism in Patients After Total Knee Arthroplasty Compared With Other Anticoagulants: A Noninferiority Analysis. *JAMA Surg* 2019; **154**(1): 65-72.
10. Maney AJ, Koh CK, Frampton CM, Young SW. Usually, Selectively, or Rarely Resurfacing the Patella During Primary Total Knee Arthroplasty: Determining the Best Strategy. *J Bone Joint Surg Am* 2019; **101**(5): 412-20.

11. Moeini S, Rasmussen JV, Salomonsson B, et al. Reverse shoulder arthroplasty has a higher risk of revision due to infection than anatomical shoulder arthroplasty: 17 730 primary shoulder arthroplasties from the Nordic Arthroplasty Register Association. *Bone Joint J* 2019; **101-B**(6): 702-7.
12. Rasmussen JV, Harjula J, Arverud ED, et al. The short-term survival of total stemless shoulder arthroplasty for osteoarthritis is comparable to that of total stemmed shoulder arthroplasty: a Nordic Arthroplasty Register Association study. *J Shoulder Elbow Surg* 2019; **28**(8): 1578-86.
13. Viveen J, van den Bekerom MPJ, Doornberg JN, et al. Use and outcome of 1,220 primary total elbow arthroplasties from the Australian Orthopaedic Association National Joint Arthroplasty Replacement Registry 2008-2018. *Acta Orthop* 2019; **90**(6): 511-6.
14. Jeyaseelan L, Si-Hyeong Park S, Al-Rumaih H, et al. Outcomes Following Total Ankle Arthroplasty: A Review of the Registry Data and Current Literature. *Orthop Clin North Am* 2019; **50**(4): 539-48.
15. Sayers A, Crowther MJ, Judge A, Whitehouse MR, Blom AW. Determining the sample size required to establish whether a medical device is non-inferior to an external benchmark. *BMJ Open* 2017; **7**(8): e015397.