

Cognitive and psychological problems after total joint replacement in older adults.

Julia Erin Scott

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Abstract

Total joint replacement (TJR) of the hip or knee is a major elective procedure that is frequently performed in older adults to treat end-stage osteoarthritis. It is generally considered to be a highly successful procedure because it significantly reduces the pain and disability caused by severe arthritis, and allows people to resume many of their everyday activities. However, there is also research to suggest that older patients may be susceptible to cognitive and psychological problems following TJR.

Research investigating cognitive and psychological outcomes following TJR has provided mixed results, making it difficult to draw conclusions to inform clinical practice. While some studies have reported evidence of postoperative cognitive dysfunction (POCD) after TJR, others have not. Similarly, the reported rates of delirium after TJR have varied enormously (0% to 82%). In addition, estimates of the prevalence of clinically significant cases of depression and anxiety among TJR patients range from very high (i.e., 85-95%) to rates that are comparable to the general population. It is also unclear whether TJR has an impact on the levels of depression and anxiety that are reported by patients.

The current thesis examined the cognitive and psychological outcomes of persons undergoing TJR surgery in order to clarify the risk of these problems in this patient population. To this end, three meta-analyses (Chapters 3-5) were conducted to evaluate the risk of cognitive and psychological problems following TJR: one examined POCD, another delirium, and one depression and anxiety. Lastly, a clinical study was conducted (Chapter 6) to address the outstanding issues within the POCD literature revealed by these reviews.

Study 1 meta-analysed research that examined cognition pre- and post TJR. Data were categorised according to the cognitive domain that was assessed (e.g. memory, attention, executive function), follow-up interval (pre-discharge, 3 to 6 months post-

surgery) and study design (single TJR group repeated measures, TJR and Control group repeated measures). Unfortunately, the incidence of POCD could not be determined because the studies did not use comparable definitions of POCD. Furthermore, limited conclusions could be drawn, largely because practice effects were generally not adequately controlled for. Overall, this meta-analysis revealed the need for methodologically rigorous research that controls for repeat testing confounds and uses a theoretically and statistically defensible definition of cognitive decline to investigate the incidence and severity of POCD after TJR.

The second meta-analysis (Study 2) investigated the incidence of delirium after TJR, and whether differences in sample characteristics (e.g. hip vs knee, general vs regional anaesthesia) and study methodology (e.g. measure, assessment interval) contributed to the variability in the incidence rates reported by different studies. Delirium was found to occur in approximately one in six patients following TJR, but the variability in findings proved difficult to explain.

Study 3 meta-analysed the research that examined depression and anxiety symptoms pre- and post-TJR. This study examined the prevalence of clinically significant levels of depression and anxiety in TJR patients, and changes in these symptoms pre- to post-surgery. Data were grouped and analysed according to the length follow-up interval. Although only limited data were available, a high proportion of TJR patients appeared to experience clinically significant levels of depression and anxiety pre- and early post-surgery. Modest decreases in symptoms were observed after surgery, but were unlikely to reflect clinically significant change. Once again, this study highlighted the fact that few studies have used a control group.

Lastly, a clinical study (Study 4) was designed to overcome the limitations in previous research identified in Study 1 by including a control group and using standardised regression-based statistical methodology to reduce the confounding effects of repeat testing (practice effects, measurement error and regression to the mean) and to provide a statistically defensible definition of POCD. In addition, this study investigated whether POCD was related to cognitive reserve, which refers to individual differences in cognitive abilities that may be protective against brain damage. Cognitive reserve has often been used to explain the lack of a clear relationship between brain pathology and the resulting symptoms, but has not yet been investigated in the context of POCD after TJR.

TJR and matched healthy control groups were recruited, and cognitive functioning was assessed using a battery of tests both pre- and post-surgery (6 months). Other variables that may have affected cognitive performance were also assessed (e.g. demographics, medical history, pain, psychological distress). This study found minimal evidence of POCD six months after TJR, with patients only experiencing significant decline in their performance on a single test. Although preliminary, this suggests that patients who undergo TJR have good cognitive outcomes post-surgery. Although at odds with the findings of many previous studies, it highlights the importance of controlling for repeated testing by using a control group and appropriate statistical techniques (standardised regression-based statistics).

Whether cognitive reserve was protective against POCD could only be explored to a limited degree because TJR patients only showed greater pre- to post-surgery decline on one task when compared to controls. Although cognitive reserve and performance on this task were not related, reserve predicted cognitive change among those TJR patients who achieved the greatest improvement and greatest decline pre- to post-surgery, suggesting that cognitive reserve is related to better cognitive recovery post-surgery among a subset

of patients. It remains to be seen whether cognitive reserve would better predict POCD in a sample with more pronounced cognitive dysfunction.

Overall, this thesis provides a summary of the literature to date on cognitive and psychological outcomes after TJR in the elderly. In addition, this thesis has addressed some outstanding questions that remain regarding POCD. The clinical implications of these findings for patients who undergo TJR are discussed, and recommendations for future research are made.

Declaration

I, Julia Scott, certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Published works

Chapter 3: Study 1

Scott, J. E., Mathias, J. L., & Kneebone, A. C. (2014). Postoperative cognitive dysfunction after total joint arthroplasty in the elderly: A meta-analysis. *Journal of Arthroplasty*, 29, 261-267. doi:10.1016/j.arth.2013.06.007.

Chapter 4: Study 2

Scott, J. E., Mathias, J. L., & Kneebone, A. C. (2015). Incidence of delirium following total joint replacement in older adults: A meta-analysis. *General Hospital Psychiatry, 37*, 223-229. doi:10.1016/j.genhosppsy.2015.02.004.

Chapter 5: Study 3

Scott, J. E., Mathias, J. L., & Kneebone, A. C. (2016). Depression and anxiety after total joint replacement among older adults: a meta-analysis. *Aging and Mental Health, 20*, 1243-1242. doi:10.1080/13607863.2015.1072801.

Chapter 6: Study 4

Scott, J. E., Mathias, J. L., Kneebone, A. C., & Krishnan, J. (2016). Postoperative cognitive dysfunction and its relationship to cognitive reserve in elderly total joint replacement patients. *Journal of Clinical and Experimental Neuropsychology, In Press*. doi:10.1080/13803395.2016.1233940.

Julia Scott

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Date: _____

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