Research Article

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Outcomes of Fractured Neck of Femur Managed with Arthroplasty at Flinders Medical Centre: A Breakdown of Demographics using Early Results of a Local Revision Registry

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ABSTRACT

Trauma comprises a significant proportion of hip surgery at our local hospital, Flinders Medical Centre (FMC). With regards to neck of femur fractures (#NOF), many cases are managed with an internal fixation approach rather than arthroplasty. National data suggest that hip arthroplasties (THAs) are increasingly being used in preference for hemiarthroplasties (HAs) for intra-capsular #NOF to improve patients function post-op. The aim of this retrospective cohort study was to continue building a robust prospective local Revision Registry in order to continue evaluate trends in local data regarding the aetiology and rates of revision hip arthroplasties at Flinders Medical Centre, where the primary arthroplasty was undertaken secondary to trauma. Data was compiled from our own documented records cross-matched with national records. Patients were included if their primary surgery was a HA or THA in the setting of #NOF, who had revision surgeries that were performed within FMC during the time period of 2016-2019. Data were evaluated descriptively with basic quantitative analyses. 455 post-traumatic arthroplasty surgeries were performed within the time frame, 78.9% of which has at our centre. Of 359 HAs performed, five were revised; of 96 THAs performed, two were revised. Revision of THAs occurred earlier, with an average of 2.17 years compared to 2.62 years. Revision of THAs occurred in younger patients, with average age at revision of THAs of 62 compared to 85.5 years. Revision of hemiarthroplasties was mostly performed due to instability of prosthetic components and patient factors, whilst revisions of THAs may have been related to surgical error. Revision of THAs seems less frequent and more related to surgical error and affects younger patients. The development of a specialised Arthroplasty service for THA in trauma may lead to an increased use of THA which is common in other centres and reduce surgical errors. Long term follow-up in the form of a local registry is ongoing and early data shows it to be a beneficial resource to guide local future management principles.

INTRODUCTION

As a major tertiary centre, arthroplasty surgeries comprise a significant proportion of orthopaedic procedures at our local hospital, Flinders Medical Centre (FMC). In 2015, a centre-based, detailed hip and knee revision registry was established locally with the purpose of analysing figures to improve patient outcomes and provide a robust research and audit tool for outcomes of these surgeries. Registries on a national level in Australia, New Zealand and Europe have been successful in providing high-quality evaluations of heterogenous data, though, present limitations in terms of detailed considerations of individual demographic and patient-centred qualitative data [1]. Initiation of our local registry aimed to evaluate in deeper detail the aetiologies of hip and knee

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revision surgeries at FMC. An important subset of hip revision arthroplasties warranting local analysis are those whereby the primary surgery was due to trauma, specifically fractured neck of femur (#NOF). It is well-established that #NOF represents a significant national and international health burden, accounting for approximately 44% of fracture-related hospital expenditure in 2016. Predictions of annual cost to the Australian taxpayer are suggesting a rise to $1.27 billion by 2022 [2]. Therefore, it is relevant to continue to use locally collected revision data to explore the management of #NOF.

At our centre, many cases of #NOF are managed with the internal fixation approach rather than arthroplasty, as is reflected both nationally and internationally [3]. However, it is evolving that total hip arthroplasty (THA) is increasingly being used in preference to hemiarthroplasty (HA) for Intra-capsular #NOF to improve patients function post-operatively, as is recommended by the Australian and New Zealand Guideline for Hip Fracture Care [4]. This change in practice is reflected internationally in countries such as the United States [3]. Despite this, significant variation still exists in practice in Australia [5]. Surgeon choice for the use of THA to manage these patients is often based on severity and classification of fracture and demographic factors that may affect outcomes following surgery. National figures report that between 2015 and 2016, 60.6% of new hip fractures were managed with internal fixation, 29.8% with HA and 8.8% by THA [6]. In general, revision rates for a primary diagnosis of osteoarthritis are lower than those with a diagnosis of #NOF [6, Figure HT4], but this difference may only be evident in early stages [3]. However, total conventional hip replacements may have higher revision rates when performed for #NOF for patients over the age of 70 years [6, Figure HT78]. According to records kept by the AOANJRR, total conventional replacements have a lower rate of revision than unipolar monoblock replacements at three months, but a higher rate than unipolar modular when performed for #NOF up to1.5 years. This then reverses, and total conventional replacements are revised less. This, however, does not appear to be the current pattern of practice in our local centre where HA is used more commonly than THA. Additionally, in patients younger than 70 years old, unipolar replacements had higher rates of revision than bipolar and total conventional replacements for a diagnosis of #NOF [6, Figure HT77]. This suggests that using THA may be preferable in younger populations.

Of 643,567 hip replacements reported by the AOANJRR in 2019, revision surgeries comprised 70,730 (10.99%) [6, Table H1]. This is consistent with statistics from previous years reported, such as in 2018 [7]. The AOANJRR reports surgical failures as a cumulative percentage revision (CPR). The CPR for all implants is reported as 5.0% for THA for osteoarthritis at 10 years post-op [6]. However, regarding arthroplasties following a primary diagnosis of fractured neck of femur (#NOF), the ten-year CPR is 7.9% for THAs. In this same demographic with regard to partial hip replacements, 7.8% of unipolar monoblock were revised; 7.5% of unipolar modular and 6.3% of bipolar [6]. Whilst these proportions are relatively low, these data suggest that further analysis of revision arthroplasties following #NOF may be warranted using locally collected registries.

The aim of this study was to analyse the aetiology and failure rates of revision hip arthroplasties at FMC where the primary arthroplasty was undertaken due to trauma. Data was compiled from our own documented records and cross checked with those collected and provided nationally by the AOANJRR in order to provide insight into the effectiveness and accuracy of this tool. A cohort of relevant cases was reviewed, with intention to highlight and consider any comorbidities and peri-, intra- or postoperative factors that may affect outcomes. This is relevant when considering best practice in our centre that strives for the best patient outcomes following trauma surgery.

A secondary aim of this study was to continue building a robust prospective local revision registry in order to evaluate changing trends in local data. Previous research by our team [8] enabled collection of data on revision knee arthroplasties. This study aims to both highlight and facilitate growth of this system in order to enable more rigorous and systematic review of trends in hip surgery for improved clinical practice.

METHODS

Ethics approval was provided by application to the Southern Adelaide Local Health Network (SALHN) Office for Research (reference number 506.15; Appendix 1). All patient and medical record information was deidentified prior to analysis. In 2015, a local Revision Registry was set up through compilation of data held at the Repatriation General Hospital with the purpose of providing a means to quantitatively track and analyse local revision data. Previously, data on revision knee arthroplasty has been analysed and published as part of other studies [9]. In this series, all patients who underwent a revision hip arthroplasty between June 2016 and 2019 were identified from this registry as well as further surgical theatre lists maintained at Flinders Medical Centre (previously the Repatriation General Hospital). Patient lists were cross-checked and compared with records of revision surgeries performed and by the AOANJRR to ensure no cases were overlooked during this process.

Patients who underwent revisions whereby their primary arthroplasty surgery for hip trauma were identified. Patient information was then requested from the AOANJRR in order to confirm their revision procedures and aetiologies, as well as to identify revision patients who were missed in initial screenings. Patients were included if they had undergone revision surgery and their primary surgery was a HA or THA in the setting of a #NOF. All cases were performed within the Flinders Medical Centre during this time period. Cases where the initial surgery was internal fixation were excluded. Associated data on identified patients, including reasons for primary surgery, dates of surgery and surgery components (including implants) and complications was pulled from paper and electronic records. Patient-specific demographic information including age, gender, body mass index and pre-existing comorbidities at the time of both primary and revision surgeries was also collected from local records.

RESULTS

Of the 105 local records of revised hip arthroplasties (THA and HA), eight were identified with the assistance of AOANJRR cross-matching of individual patient data as having a primary diagnosis of fractured neck of femur. Of these, the primary surgery of two were THAs, and the remaining six were HAs. Of the eight revisions, seven were identified through local records as being revised to total hip replacements. One HA patient was incorrectly identified as a revision following primary surgery following #NOF and was subsequently removed from the dataset.

Table 1 represents the total numbers of #NOFs presenting to Flinders Medical Centre and the Repatriation General

Hospital within this time frame and their approach to surgical management. Hemiarthroplasties (both unipolar and bipolar) were more commonly performed over THAs for traumatic #NOFs within the timeframe, accounting for 78.9% of all cases. Of the 359 hemiarthroplasties following #NOF performed within this timeframe (unipolar modular and bipolar), there were six revisions (1.67%) identified through local records. Of 96 total conventional THAs, there were two revisions (2.08%) documented in our local records.

Table 1: Total number #NOFs at Flinders Medical Centre managed with arthroplasty between 2016-19.

Year	Unipolar Modular	Bipolar	Total Conventional	Total
2016	89	4	15	108
2017	58	14	31	103
2018	77	22	26	125
2019	41	54	24	119
Total	265	94	96	455

Hemiarthroplasties

Of the six revised hemiarthroplasties identified through our records, all were to cement THAs. Four revisions used a lateral approach and two an anterolateral approach. It is noted that patient #2 initially underwent revision of the acetabular component prior to undergoing multiple total revisions. The average time between primary surgery and revision surgery was 2.62 years with a median of 2.63 years. Average age at revision of the partial replacements was 85.5 years. Of the patients within this subset, multiple reasons for revision were documented, with the most common being loosening, instability and dislocation. Further reasons for revision included avulsion of the gluteal tendon, acetabular degeneration with a likely diagnosis of progression of osteoarthritis and septic loosening of the prosthesis Table 2.

Table 2: Revised hip replacements for primary surgery following #NOF at Flinders Medical Centre between 2016-19.

Patient	Age at Revision	Fracture	Primary Surgery & Approach	Revision Type	Revision Reason	Time TO Revision
1*	83	R) NOF	R) cemented hemiarthroplasty Lateral	Acetabular component	Acetabular fracture; recurrent dislocations	4y, 11m
2**	79	R) sub capital NOF	R) cemented hemiarthroplasty Left lateral	THA	Septic loosening, pain, avulsion of gluteus tendon	2y, 3m
3	89	R) NOF	R) cemented hemiarthroplasty Anterolateral	THA	Dislocation	1y, 3m
4	91	R) NOF	R) cemented hemiarthroplasty Anterolateral	THA + bone graft	**	3y, 0m
5	88	L) sub capital NOF	L) cemented hemiarthroplasty Anterolateral	THA + bone graft	Acetabular degeneration? OA	1y, 9m
6	56	R) NOF	R) THA Lateral	THA	Oversized acetabular component with iliopsoas impingement	1y, 7m
7	68	R) NOF	R) THA Posterior	THA	Recurrent dislocations	2y, 9m

*Multiple revisions

**Revision indicated and planned, cancelled due to systemic illness

Notably, a differing comorbidities profile was noted between the partial and total replacement groups. Patients in the partial replacement group had more systemic comorbidities at the time of their revision surgery than those in the total replacement group (Table 3). Each patient within this group had documented comorbidities in at least three body systems. Table 3 for summary of primary arthroplasties and their surgical approaches.

Table 3: Summarised comorbidities of patient cohort.

Patient	Orthopaedic & Musculoskeletal	Other
1	Osteoporosis	Hypercholesterolaemia, IHD
	L) THA	T2DM (undiagnosed at primary surgery)
		Bell's Palsy 1997
2	L) #NOF with THA, not revised	AF, HTN
		Glucose intolerance, obesity
3	Nil	Hypercholesterolaemia
		PVD, 75% stenosis popliteal artery
		TIA
4	Osteoporosis	Asthma
	Osteoarthritis	GORD
		Glaucoma
		Depression
5	Chronic low back pain	Mild COPD, asthma
	Polymyalgia rheumatica	Bladder TCC
6	Mobility impairment	Vasovagal collapses
		VA shunt for hydrocephalus
		Temporal lobe epilepsy
		Chronic analgesia overuse
		Restricted visual fields
		Collapses
7	Laminectomy 1990s	Essential tremor with DBS insertion 2016
	Chronic low back pain	Migraines

Total Hip Arthroplasties

Of the two THAs identified, one was of initial lateral approach and the other posterior. The average time between primary surgery and revision was 2.17 years. Average age at revision of the partial replacements was 62 years. One revision was performed due to the original acetabular component of the prosthesis being incorrect in size, resulting in iliopsoas tendon impingement, pain and reduced mobility in the setting of pre-existing, chronic mobility impairment. The other revision was undertaken due to recurrent dislocations of the original prosthesis. Both patients had musculoskeletal and neurological comorbidities, but no record of other systemic disease at the time of their revision.

Comorbidities

Of the HA group, all suffered a form of cardiorespiratory comorbidity and one patient was obese. Two of the six had documented hypercholesterolaemia. Two had previous THAs, one being from a previous #NOF. Two had osteoporosis. Of the THA group, both suffered neurological comorbidities, one significantly, resulting in mobility impairment from early life.

DISCUSSION

This study allowed for an early and basic descriptive analysis of the numbers and demographics of revised arthroplasties following primary surgery for #NOF in our centres (RGH, FMC). Data from revision hip arthroplasties collected from June 2016-2019 was evaluated retrospectively with regards to reasons for revision, time from primary replacement to revision and patient demographics of revision. Numbers from this study have allowed us to compare centre-based trends with national figures in regard to the management and revision rates of hip arthroplasties. Revision numbers were lower than expected within the time-period with the high numbers of trauma surgeries performed annually at our centre.

Revision of THAs was seen to occur slightly earlier than the revision of hemiarthroplasties with an average time to revision of 2.17 years compared to 2.62 years. This correlates grossly with national data from the AOANJRR, with THAs being revised at higher rates at 1 and 5 years when compared to HAs. Revision of THAs occurred in younger patients compared to hemiarthroplasties at 62 years compared to 85.5 years. It is relevant to note that primary surgery of THAs occurred with younger patients compared to hemiarthroplasties. This is likely related to age being an important factor in determining the surgical management of #NOF, with hemiarthroplasties generally being used for more elderly patients.

Revision of hemiarthroplasties was mostly performed due to instability of components of the prosthesis as reflected in the increased time between primary surgery and revision. Instability of the acetabular component was the most common reason for revision. Dislocation was present in two patients and prosthetic infection in one other. Another patient suffered acetabular degeneration in the context of chondrolysis and progressive osteoarthritis. These observations are consistent with national figures regarding aetiology for revisions in hemiarthroplasties [6, Figure HT77]. It is interesting to note that one of the revised THAs was done so due to an oversized prosthesis resulting in iliopsoas tendon impingement; this is most likely to be caused by surgical error rather than failure of the implant. The second revised THA was due to recurrent dislocations. Whilst the posterior approach has been considered a potential risk for dislocation this has been

repeatedly discredited in recent literature, regardless of the use of precautions [10-12]. It is therefore difficult to judge whether this occurred due to the prosthesis choice or patient factors. Revisions of THAs may have been related to surgical technique, and less related to patient factors and comorbidities, as discussed below. This prompts consideration into the use of THAs in managing traumatic #NOF and whether they may pose less complications and revisions.

All patients who underwent revision of HAs had documented cardiorespiratory comorbidities. It is previously reported that comorbidities result in worse outcomes for THAs across the board [13], with cardiovascular diseases increasing the risk of revision as reported by multiple studies [14, 15]. All patients in the HA group suffered comorbidities in at least three systems at the time of primary surgery, all but one including at least one musculoskeletal comorbidity. These numbers support the idea that an increased comorbid profile correlates with increased risk of revision; however, this may also represent the practice within our centre that hemiarthroplasties are performed on more systemically unwell patients at the time of their initial surgery. This concept is consistent with other studies suggesting that patients with more medical comorbidities and less functional independence tend to undergo HA surgery [16]. Those revised patients who underwent THAs appeared to have less systemic comorbidities, as well as being younger in age.

Both patients who underwent THAs had documented neurological conditions which may have compounded their risk of failure: patient 6 had a long history of neurological disability resulting in mobility conditions and was not independent at baseline. Patient 7 suffered essential tremor in the context of Parkinson's Disease, managed with deep-brain stimulation (DBS) and chronic low back pain. Neither suffered osteoporosis or osteoarthritis, and neither had documentation of cardiovascular disease. The revised THAs, despite these conditions, had documented less systemic illnesses and may have been less significantly comorbid at the time of their primary surgeries. This is a difficult observation to make in the face of early observational data alone; however, may explain their younger age at time of primary surgery and revision, and justify the use of THA in place of HA for their fracture. Miller (2014) document the use of THA for management of #NOF in younger populations due to less risk of complication, determined by preoperative assessment of the patient by the primary surgeon. The fact that both THA patients suffered neurological complications is also relevant; whilst younger and presumptively fitter, this poses questions with regards to the reasons for the shortened lifetime of their prosthesis given a centrally mediated imbalance of joint and muscle function. A systematic review concerning THA in neurological conditions, however, found that THAs may provide favourable outcomes in neurologically disabled patients combined with the use of constrained implants to reduce the risk of prosthetic instability during recovery [17]. Nevertheless, these observations suggest that neurological complications pose a risk to the success of THAs in #NOF at our centre.

It is important to note that the dataset obtained provides limited ability to quantitatively evaluate significant differences between HA and THA revision groups in large numbers. These are early, preliminary data collected from local records that were individually cross matched nationally, and do not provide, at this stage, opportunity for formal or sophisticated analysis of outcomes but rather a platform from which to base ongoing research. This further highlights the benefit of continuing to maintain a local registry of both hip and knee surgeries prospectively in order to continuously evaluate trends in data surrounding revisions. Furthermore, it is noted that data collected from our local registry is unable to capture or to follow patients who were lost to follow up or revised in a different centre or state. This further emphasises the need to use the AOANJRR as a tool to cross-check and provide reliability to data collected by local registries. Data maintained by staff at our site would provide detailed data with more granularity of information on a patient-to-patient basis and allow for a greater degree of understanding of the outcomes of hip prosthesis based on approach and patient demographics.

CONCLUSION

This study provides early insight into the frequency and aetiologies of revision hip arthroplasties from primary trauma hip surgeries at our centre. Interestingly, we had lower overall revision numbers than we expected. It indicates that revision surgeries may occur less frequently from primary hemiarthroplasty surgeries than THA. Overall, the uptake of THA for fracture is low in our centre compared to national figures and further review is required and underway to evaluate if more local experience could reduce trauma THA revision rates.

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