Rural Experience With The Austofix F2 Femoral Nail For Peri-Trochanteric Femur Fractures.

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Abstract

Rural health care provision is repeatedly substandard in comparison to that offered in urban settings, with many factors involved. Budgetary constraints, geographical limitations and professional isolation render best practice health care problematic. Sustainable, cost-effective health service provision is always the aim, but must constantly be tempered against evidence-based best practice. Our review aimed to highlight local experience with the Austofix F2 femoral nail for treatment of peri-trochanteric femur fractures, and to assess this relative to evidence-based best practice. The development of Z-deformity in 29% of patients requiring revision of implants in 26% has led to a change of implant usage at our institution, and raises questions of the utility of dual sliding screw systems for proximal femoral fracture management.

INTRODUCTION

The difficulties faced in providing adequate specialist trauma care in a rural setting are well known[1,23]. The responsibilities of a rural health practioner are greater than those for urban counterparts, and are undertaken in relative professional isolation[3]. Budgets are lower than for larger institutions, quantities of resources utilised are lower which has implications for cost when purchasing[2], and resupply of implants has the added complications of distance and time. All too often the decisions made for use of implants at an institution are outside the control of medical practioners, and comes down to the cost of the item and thus sustainability of service provision. It is a constant battle that must be fought by all surgeons, particularly those in regional areas, to ensure that health care provision is occurring using resources that are in line with current evidence-based best practice. This involves not only a cost-benefit analysis, but regular clinical reviews to assess treatment regime success in comparison to current literature.

Dubbo is a rural centre in NSW situated 410 km NW of Sydney, with a population of 42000. The drainage area for Dubbo Base Hospital involves a substantial portion of the north western sector of the Western NSW Area Health Service, which services a population estimated in 2011 to be 266000[4]. The hospital itself is a hospital with 3 fully equipped theatres and 1 endoscopy theatre. It currently is staffed from the orthopaedic perspective with 2 registrars, one a trainee with the Australian Orthopaedic Association and the other a non-accredited registrar, with 9 orthopaedic consultants who service the centre from Sydney hospitals on a rotating roster. As such, the sub-specialty services provided at Dubbo include trauma, arthroplasty, shoulder + upper limb, foot + ankle, and spine.

AIMS

Our series review aimed to assess local clinical outcomes with the use of the dual screw Austofix F2 femoral nail in a rural setting.

METHODS

75 peri-trochanteric fractures were treated at Dubbo Base Hospital from 2006 until December 2011. All fractures were confirmed preoperatively on plain radiographs or CT scans, and informed consent gained for fracture fixation using an intra-medullary nail. Patients were not informed as to the specific nail type to be used for fixation.

The primary endpoint sought was complete and uneventful clinical and radiological fracture union. Secondary endpoint was revision of the prosthesis for any reason. Medical records were reviewed, in particular outpatient clinic records, and radiology reviewed for signs of implant migration and fracture fixation/alignment.

Austofix F2 cannulated nails were used in 75 patients with peri-trochanteric femur fractures. All cases were performed

with the patient supine on a traction fracture table using image intensifier guidance. Proximal trochanteric entry was identified under II, with a 13mm entry opened. The decision to pre-ream the canal or insert the nail primarily was at the discretion of the performing surgeon. Only cannulated nails were used, with x2 proximal locking screws at 125 degrees in recon mode, and either 1 or 2 distal locking stainless steel screws. Procedures were performed by consultants or training registrars with consultant supervision.

Postoperative care involved 24-48 hours of intravenous antibiotic prophylaxis, venous thrombo-embolic prophylaxis in the form of compressive stockings, foot pumps, and chemical prophylaxis with heparin or LMWH. Patients were allowed to commence immediate weight bearing with physiotherapy guidance. The endpoint for discharge was independent mobility suitable for each patient's home, or transfer to a rehabilitation unit until that could be arranged. Patients in nursing home care with appropriate physiotherapy cover were discharged back to their nursing home.

All follow-up was conducted through consultant supervised outpatient orthopaedic clinics, with reviews planned for 2 weeks for wound review, 6 weeks, 3 months and 1 year for x-ray and mobility assessments. Compliance with follow-up was suboptimal at best.

RESULTS

Of the 75 Austofix F2 nails inserted, 25 were lost to follow-up, and 15 had incomplete medical records or absence of radiographs post surgery. As such, conclusions as to the success of the procedure in 40 patients cannot accurately be made. The remaining 35 patients had adequate medical records and medical imaging such that the success of the fixation was able to be judged. There were 11 patients in whom issues were identified with the fracture fixation. 1 patient developed a deep wound infection that was refractory to antibiotic therapy alone and required revision of the prosthesis to an alternate nailing system. A common theme in those that required revision of the prosthesis was failure of the sliding mechanism of the proximal screws. In particular we noted the occurrence of a Z deformity pattern in which the superior proximal screw failed to slide within the nail whilst the inferior screw slid as designed during fracture compression/collapse. This pattern was noted to be occurring in 1 patient but with maintenance of acceptable position, and in 9 patients where revision of the prosthesis was required. The Z deformity pattern of hardware failure was thus noted in 29% of patients followed up adequately in our series. The large volume of patients lost to follow-up may adversely inflate these figures. If we assume that all 40 patients lost to adequate follow-up failed to develop any complications, then only 13% of patients developed the Z deformity pattern. Considering 9 of 35 did develop an issue with failure of proximal screw sliding, it is likely that a similar proportion of those lost to follow-up would likewise have had similar outcomes.

No patients were found to have screw cut-out independent of the Z-deformity pattern. In our limited series we also noted no fractures distal to the intra-medullary nail. Mortality rates and medical complications such as DVT or PE were also not measured in this series review.

DISCUSSION

The optimal management of peri-trochanteric femur fractures remains a topic of much contention, with some reviews suggesting superiority of pin + plates for inter-trochanteric fractures[6], and others suggesting equivalent results overall[5,19], and even superior results in certain situations5. Prospective, randomised studies assessing dynamic hip screw and plate constructs with intra-medullary fixation devices have shown that intra-medullary devices are superior to plates for unstable fracture patterns, but show higher complication rates over plates with stable peri-trochanteric fracture patterns[10-13]. Improved implant design has reflected in more recent studies as comparable outcomes with newer intra-medullary devices as compared to sliding hip screw and plates[5]. A number of problems with existing nails have been identified such as lag screw prominence with fracture settling, large proximal trochanteric entries with possible fracture, and penetration of the anterior femoral cortex due to nail-femur mismatch, and potential for Z effect[19]. This Z phenomenon was first reported by Werner-Tutschku et al who described a complication of double lag screw intra-medullary nail designs in which the 2 proximal lag screws appeared to migrate in opposite directions during physiologic loading. The exact mechanism for this is unclear, and though previously thought not to occur in nail designs incorporating a lag screw that slides within the nail[19], our current experience is otherwise. Some have suggested that the smaller diameter screws may be more prone to bending, which could lead to failure of the sliding mechanism[21]. There is also the concern that smaller diameter screws have an increased tendency for migration through the femoral head[22].

A common theme in other articles assessing intra-medullary nail fixation of peri-trochanteric fractures is the need for optimal screw placement in the femoral head[14-18]. Tip-apex distances of <20mm with screw placement centrally in the head on both AP and lateral hip films are essential to reduce the rate of screw cut out and thus implant failure. Davis et al[14] noted in a series of 230 patients that screws placed posterior of centre in the femoral head had higher rates of cut-out at 27% compared to those placed centrally at 7%. The use of single femoral screw implants such as the PFNA (Synthes) and Gamma3 nail (Stryker) negates the risk of developing a Z deformity pattern, but with single screw fixation, screw position becomes even more vital for implant success[6,7]. Biomechanical analysis of varying fracture fixation devices has identified that dual screw systems require significantly greater forces to initiate sliding than do single screw systems[9]. It has also been noted that the force required to initiate sliding increases as barrel length increases. The DHS system (Synthes) had the lowest force to initiate sliding at 42.33N, with the Gamma nail at 79.33N and the Austofix hip nail at 283.00N[9]. The authors postulate that the statistically significant increase in force required for initiation of sliding of the proximal lag screws in a dual screw system such as the Austofix hip nail explains for the propensity for failure of screw sliding.

Our experience with the Austofix nail has again highlighted the potential flaw of dual sliding screw nailing systems. The increased forces required to initiate sliding of the screws translates clinically to an increased risk of failure of this mechanism, with subsequent development of medial screw migration or Z deformity. From our series the rate of failure for initiation of sliding was higher in the proximal screw, with all failures occurring with this part of the system. Further clinical investigation of the system is required to identify if the mode of failure we have observed in our series is an accurate representation of the systems function outside of our institution. The high revision rates experienced in our rural setting, coupled with the overwhelming data in support of single screw systems such as the PFNA (Synthes) or Gamma nail (Stryker)[7], has led to a change in system utilisation. Newer designs utilising dual screw femoral head fixation such as the Intertan nail (Smith + Nephew) show promise. Such devices provide superior rotation control by nature of the 2 head screws, with the literature suggesting that failure rates are significantly lower than other dual screw systems[8]. Further clinical monitoring will hopefully reveal a reduction in nail revision rates, and lead to a more cost-effective and clinically successful peri-trochanteric fracture system being utilised in our rural setting.

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