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Short versus long thread cannulated cancellous screws for intracapsular hip fractures: A randomised trial of 432 patients

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ABSTRACT

It is unclear which length of thread may be most advantageous for the internal fixation of an intracapsular fracture with cancellous screws. We have compared the 16 mm versus the 32 mm threads on cancellous screws within a randomised trial for 432 patients. All fractures were fixed with three screws and patients followed-up for a minimum of one year from injury.

The characteristics of the patients in the two groups were similar with a mean age of 76 years. 23% were male. The most common complication encountered was non-union of the fracture which for undisplaced fractures occurred in 7/107 (6.5%) of short threaded screws versus 11/133 (8.3%) of long threaded screws. For displaced fractures the figures were 29/104 (27.9%) versus 24/89 (27.0%). Other complications for the short versus long threaded group were avascular necrosis (two cases versus five cases) and fracture below the implant (two cases in each group). Elective removal of the screws for discomfort was undertaken in five and three cases, respectively. None of these differences between groups was statistically significant. In summary there is no difference in fracture healing complications related to the length of the screw threads.

Introduction

Numerous implants are available for internal fixation of intracapsular fractures. Tronzo in 1987[10] estimated that there were approximately 100 different implants, and since that time a number of further implants have been developed. The current trend in implants is to use multiple parallel cancellous screws. Currently practice at our hospital is to use 6.5 mm cannulated AO cancellous bone screws. The bone screws are manufactured and supplied in two versions, one with 16 mm of thread and the other 32 mm of thread.

The recommendations from the designers of AO screws are unclear but tend to recommend the shorter threaded screws. The potential disadvantage of the long threaded screws is that the threads may cross the fracture line and thereby impede fracture consolidation and increase the risk of fracture non-union. Recent reports have however indicated that a longer length of thread may be beneficially. A study of cadaveric femoral heads,[3] found that the pull out strengths of the longer threaded screws to be almost twice that of the shorter screws. A further study suggested that compressing the fracture, as occurs with the shorter screws may impair fracture healing.[2]

There have been no randomised trials comparing the two different types of screw. The aim of this study is to perform a randomised trial to compare short (16 mm) versus long (32 mm) threads on the cannulated cancellous screws.

Patients and methods

432 patients were recruited from April 1996 to July 2005. The method of randomised for all patients was by the single toss of a coin, heads to 6.5 mm cancellous screws with short threads (16 mm) and tails to long threads (32 mm) (Stratec Medical, Hertfordshire, UK). All screws were inserted using the fracture table and the image intensifier in a percutaneous technique.[6] Undisplaced fractures were fixed in situ and displaced fractures were reduced closed. After surgery all patients were allowed to mobilise fully weight bearing, except for patients aged less than 60 years in which a period of a few weeks partial weight bearing was recommended. All surviving patients were initially followed up in a hip fracture clinic for one to four visits and then by phone to one year from injury. Those with symptoms were asked to re-attend the clinic for radiographic review. Mean X-ray follow-up of the survivors without fracture healing complications was a mean of 266 days (median 171, range 25–3521 days). In addition if patients were referred back to the hip fractures service after one year with complications, these complications were included within the results. 12 patients

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alive at one year had no X-ray follow-up as they refused to attend or were too frail.

On admission the patients' pre-operative characteristics were recorded. These included the patients age, sex, pre-injury residence (own home versus institution/care home) and type of fracture (undisplaced versus displaced). Mobility was assessed using a scale of 0–9.[5] 9 represents full mobility indoors and outdoors without walking aids; 0 represents a bed-bound patient. The use of walking aids within the home was also noted. Mental agility was scored using a standard "mini mental-state test".[8] One point is scored for each correct answer including short and long term memory questions, simple arithmetic, concentration and orientation in time and place. A range is therefore possible from 0 (unable to answer a single question) to 10 (full marks). Co-morbidity was documented, as was pre-operative haemoglobin concentration. The American Society of Anaesthesiologists (ASA) grading was employed for assessing pre-operative morbidity.[1] Non-union was identified from AP and lateral radiographs if there was either displacement of an undisplaced fracture, re-displacement of a displaced fracture or failure of the fracture to heal, with clearly visible fracture margins, at one year from occurrence of the fracture. Avascular necrosis was for stages II–VI as defined by Steinberg classification method.[9]

Statistical evaluation between the two groups was undertaken using the Fisher exact test for dichotomous outcomes and the unpaired *t* test for continuous outcomes. A *p*-value of less than 0.05 was considered as statistically significant.

Results

Out of 432 patients 210 were fixed with short threaded (16 mm) screws and 222 were fixed with long threaded (32 mm) screws. All patients received the type of screws to which they were randomised. The characteristics of the patients for the two groups are as detailed in Table 1. For the two groups of patients, none of the differences between these groups was of statistical significance.

Table 2 lists the fracture healing complications related to the two different types of screws. The final outcome measures are listed in Table 3. Residual pain is a pain score of three or more, which equates to the level of those patients having some pain on walking and using occasional analgesia or more severe than this. None of the differences between the two groups was statistically significant.

Table 1
Patient characteristics (percentage) [range].

	Short thread	Long threads
Number of patients	210	222
Displaced fracture	103 (49%)	89 (40%)
Mean age	76 [29–96]	77 [31–99]
Male	47 (22%)	53 (24%)
From own home	168 (80%)	165 (75%)
Mean ASA grade	2.7	2.7
Mean mobility score	4.8	5.1
Mean mental score	6.5	6.0

Table 2
Fracture healing complications for the two groups (percentage).

	Short threads	Long threads	*p*-Value
Undisplaced	107	133	
Non-union	7 (6.5%)	11 (8.3%)	0.17
Fracture below	1 (0.9%)	0	0.45
Avascular necrosis	0	1 (0.8%)	0.55
Removal	5 (4.7%)	3 (2.3%)	0.25
Re-operation	15 (14.0%)	16 (12.0%)	0.14
Displaced	104	89	
Non-union	29 (27.9%)	24 (27.3%)	0.53
Fracture below	1 (1.0%)	2 (2.3%)	0.34
Avascular necrosis	2 (1.9%)	4 (4.5%)	0.19
Removal	6 (5.8%)	6 (6.8%)	0.22
Re-operation	38 (36.5%)	34 (38.6%)	0.44
All fractures	210	222	
Non-union	26 (12.4%)	35 (15.8%)	0.14
Fracture below	2 (1.0%)	2 (0.9%)	1.00
Avascular necrosis	2 (1.0%)	5 (2.3%)	0.51
Removal	11 (5.2%)	9 (4.0%)	0.33
Re-operation	53 (25.2%)	50 (22.5%)	0.15

Table 3
Final outcomes for the two groups [standard deviations] (percentage or number of patients assessed).

	Short threads	Long threads	*p*-Value
One-year mortality	48 (23%)	44 (20%)	0.48
Number with residual pain	48 (32%)	45 (26%)	0.22
Mean pain score	2.1 [1.07] (147)	2.0 [0.98] (171)	0.39
Mean change mobility score	1.3 [1.6] (158)	1.0 [1.6] (176)	0.09
Normally used a walking aid	75 (47%)	90 (51%)	0.51
Same residence status	145 (91%)	163 (93%)	0.84

Discussion

The choice of fixation for the internal fixation of an intracapsular hip fracture remains controversial with there being many different implants including the sliding hip screw, cancellous screws, smooth nails, and pins. A review or randomised trials that have compared the different implants suggested that screws provide better stabilisation of fixation than pins.[7] Most of the implants that are used have threads that do not cross the fracture, but some implants specifically had threads that cross the fracture line.[4] An extensive search of the literature for all randomised controlled trials on the topic of internal fixation implants for intracapsular hip fractures found no studies that have addressed the issue of the most appropriate length of thread for the screws.[7] Screws were however found to have a tendency to lower fixation failure rates in comparison to smooth pins within this review.[7]

The strength of this study is the randomisation of the patients to ensure the two groups of patients are similarly matched. The treatment options, other than the choice of thread length, were identical for both groups of patients. Deficiencies in this study were it was not possible to follow-up all patients with a full set of radiographs. There will always be some loss of patients from mortality. Furthermore for this elderly group of patients it is not possible for all patients to attend out-patient follow-up for a full radiographic review. Ideally a minimum two-year follow-up is required as avascular necrosis can present within this time period. From the absence of any trend in favour of one of the screw types it is highly unlikely that any significance will be found even if there was a large number of patients or more prolonged follow-up was undertaken.

We accept that method of randomisation in this study using a single toss of a coin, wound now be considered inadequate. When the study was started in 1996 many orthopaedic trials were quasi-randomised using items such as the patients even or odd medical records number. Therefore, the group to which the patient was going to be allocated was apparent before entry into the study. The toss of a coin is superior to quasi-randomised methods but inferior to methods such as sealed opaque envelopes.

This study demonstrated that there were no statistical differences between the short and long threaded screws for any

of the outcomes recorded. The cost of using three long threaded screws in our hospital is approximately £6 (10 US dollars, 7 Euros) more than that for three short threaded screws. In conclusion there is no difference in outcome between the different screw threads.

Conflict of interest

Both authors also declare that they have no conflict of interest in connection with this paper. In addition no benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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