Managing fractures of the distal radius in adults

Clinical and research implications from systematic reviews of existing trials

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Fractures of the distal radius are one of the most common fractures in many areas with predominantly white and older populations (Sahlin 1990, Singer et al. 1998). It has been estimated that, at 50 years of age, a white woman in USA or Northern Europe has a 15% lifetime risk of a distal radius fracture whereas a man has a lifetime risk of just over 2% (Cummings et al. 1985). A recent prospective survey of patients, aged 35 years and above, with Colles' fracture in six centers in the UK reported the overall annual incidence of this fracture to be 9/10,000 in men and 37/10,000 in women (O'Neill et al. 2000). Distal radial fractures are usually treated on an outpatient basis with around 20% of patients (mainly older people) requiring hospital admission (Cummings et al. 1985, O'Neill et al. 2000). The majority of distal radial fractures are treated non-operatively.

It has been long recognized that these injuries can result in increased morbidity, with long-term functional impairment, pain and deformity (Bacorn and Kurtzke 1953, Gartland and Werley 1951). They are also associated with a high incidence and variety of complications; for example, serious complications, such as persistent neuropathies of the median, ulnar or radial nerves, have been reported in 1 in 3 patients (Cooney et al. 1980). Some can be directly attributed to treatment, notably pin-site infection for external fixators.

We set out to identify and examine the evidence of effectiveness of conservative and surgical interventions in the management of these fractures in adults. We undertook 2 systematic reviews with the support of the Cochrane Musculoskeletal Injuries Group (CMSIG); one of the 50 Collaborative Review Groups covering various aspects of health care in the Cochrane Collaboration. The latter international, not-for-profit organization aims to help people make well-informed decisions about healthcare by preparing, maintaining and promoting the accessibility of systematic reviews of the effects of healthcare interventions. Further information can be obtained from the Collaboration's World Wide Web site: http://www.cochrane.org.

Methods

The reviews included all published randomized or quasi-randomized (employing methods which are not strictly random e.g. alternation) clinical trials comparing various conservative and / or surgical interventions in the management of distal radial fractures in adults. As well as the study inclusion criteria, details of the search strategy for identifying trials and methods of the review including study selection, the assessment of methodological quality, data extraction and analysis were published as a protocol. The methods followed and adapted the comprehensive guidelines on the preparation and maintenance of Cochrane reviews provided by the Cochrane Collaboration (Clarke and Oxman 2001).

All eligible trials were independently assessed by both reviewers using an 11 item checklist devised

Table 1. Conservative treatment comparisons

Intervention /Comparison • Sub-comparison	Number of trials	Number of patients	% available for analysis
Reduction versus none	1	30	100%
Delayed manipulation	1	80	N/A
Forearm in different positions in plaster cast	6	~650	
• Supination / neutral versus pronotion	3	~150	~55%
• Palmar / neutral versus dorsiflexion	2	254	100%
• Ulnar deviation versus no ulnar deviation	1	250	N/A
Plaster cast type A versus type B	5	~560	
• Special modified cast versus standard	1	90	100%
• Above-elbow versus below-elbow cast/slab	2	170	55%
• Below-elbow slab versus below-elbow cast	2	~300	N/A
Forearm in different positions in brace	2	296	
• Above-elbow: supination versus pronation	1	154	46%
• Above-elbow (supination) versus below-elbow	1	142	92%
Plaster cast for different durations	6	445	
• 3–4 weeks versus 5–6 weeks	4	331	84%
• 1 week versus 3 weeks	2	114	88%
Brace versus plaster cast	8	~1260	~41%
Bandage (minimal support) versus cast / brace	4	~230	~90%
Different types of cast material	3	135	
• Polyurethane cast with zipper	1	50	92%
• Thermoplastic bandage	1	55	100%
• Shrinkable polymer versus fibreglass tape cast	1	30	100%

Missing data for some trials prevented exact enumeration of patients in some comparisons

by the CMSIG. The items covered in the checklist were: allocation concealment; intention-to-treat analysis; assessor blinding; baseline characteristics; participant blinding; care provider blinding; care program comparability; inclusion criteria; outcome definition; adequate outcome assessment; and duration of follow-up. Relevant data from trials were abstracted onto a pre-piloted form and the two reviews were compiled using the Review Manager software (RevMan 4.1) provided by the Cochrane Collaboration. Where data were available, relative risks and 95% confidence intervals were calculated for dichotomous outcomes and mean differences and 95% confidence intervals for continuous outcomes.

Results

75 trials, involving 6,565 mainly female and older patients, were included in 2 Cochrane reviews (Handoll and Madhok 2001). These were mainly single center trials performed in 20 countries; there was 1 international trial. The earliest trial was published in 1980. Most of the trials were reported in English; translations being obtained for 2 trials in French, 2 in German and 1 in Danish.

Overall, the 75 trials were only of poor to moderate quality as rated by the methodological checklist. Using the three prime measures of internal validity which are reported to affect the results of trials (Schultz et al. 1995), we found the following:

- Allocation concealment: only 3 trials clearly used secure methods of randomization. No details of the method of randomization were provided in the reports of 41 trials.
- Intention to treat: just 9 trials gave a full account of the patients recruited / lost to follow-up, and undertook appropriate analyses.
- Blind assessment: outcome assessors were blinded to treatment allocation in only 1 trial; another 7 trials had blind assessment of some outcome measures. Five others had independent assessors, however this was not rated.

31 trials with 3,372 patients studied conservative interventions. Table 1 shows the comparisons evaluated by these trials, grouped according to the main questions addressed by each trial. Eight trials had more than 2 intervention groups and, where

Table 2. Surgical treatment comparisons

Intervention /Comparison • Sub-comparison	Number of trials	Number of patients	% available for analysis (Pooled data[a])	
Surgical treatment versus conservative treatment	22	~1700		
• External fixation (EF)	13	859	89%	(AFC)
• Percutaneous pinning (PP)	5	363	100%	(FC)
• Open reduction and internal fixation (ORIF)	1	62	68%	
• Bone scaffolding (graft / substitute)	3	219	98%	(AFC)
• Bone substitute versus plaster cast / EF[b]	1	~210 / 323	(84%)	
• Ligament repair and ulnar styloid fixation	1	41	98%	
Surgical treatment A versus B	10	~750		
• PP versus EF	2	156	91%	(FC)
• Medullary pinning versus EF	1	100	100%	
• ORIF versus EF	1	57	65%	
• Bone scaffolding versus EF	3	180	94%	(C)
• Bone substitute versus plaster cast / EF[b]	1	~110 / 323	(84%)	
• OR + plate F versus arthroscopic R + PP	1	37	N/A	
• OR + plate F + EF versus arthroscopic R + PP	1	34	N/A	
• Arthroscopic R, PP and EF versus ORIF	1	96	85%	
Variants of surgical treatment: external fixation	9	468		
• Pins and plaster EF versus external fixator	2	149	95%	(C)
• Dynamic versus static	3	169	60%	(C)
• Non-bridged versus bridged (over wrist joint)	2	80	70%	
• Five pin versus four pin	1	50	96%	
• Hydroxyapatite coated versus uncoated pins	1	20	100%	
Variants of surgical treatment: internal fixation	6	402		
• Kapandji versus trans styloid fixation	1	120	80%	
• Kapandji versus Py's isoelastic pinning	1	110	80%	
• Pi-plate versus two 1/4 tube plates	1	65	71%	
• Biodegradable versus metal pins/wires	2	70	100%	
• OR + plate F + EF versus OR + plate F	1	37	N/A	
Plaster cast for different durations after surgery	2	120		
• 1 week versus 6 weeks	2	120	98%	(C)

[a] Type of outcome pooling performed: A (anatomical), F (functional), C (complications).
[b] This trial comparing bone substitute with conventional treatment (plaster cast or external fixation) appears in 2 categories.

appropriate, featured in 2 or more comparisons. No pooling of multiple trial comparisons was undertaken because of marked heterogeneity in trial characteristics and lack of comparable outcome data.

41 trials with 3,193 patients studied surgical interventions. 21 of these compared surgical intervention with conservative treatment, always plaster cast immobilization for about 6 weeks. Table 2 shows the comparisons evaluated by these trials, grouped according to the main questions addressed by each trial. Three trials had more than 2 intervention groups and featured in 3 or 4 comparisons. One trial, which compared bone substitute with conventional treatment consisting of plaster cast immobilization or external fixation, is listed under 2 separate categories. Despite the variation in trial characteristics, some pooling of data was considered appropriate. However, the lack and variety of the available outcome data limited pooling.

Readers are encouraged to look at the 2 reviews (Handoll and Madhok 2001), published in the Cochrane Database of Systematic Reviews, for a comprehensive account of the included trials' characteristics and results for each comparison. In summary, the reviews found:

- A wide range of interventions had been used to treat distal radius fractures.
- There was insufficient robust evidence from randomized and quasi-randomized clinical trials for most of the interventions used.
- There was some evidence that some surgical methods showed better anatomical outcomes but there were insufficient data on other outcomes to

determine whether surgical intervention of most fracture types will produce consistently better long-term outcomes.

These findings reflect the limited scope, quantity and usually uncertain validity of the available evidence from the trials included in the reviews. Heterogeneity and incomplete data either hindered or prohibited pooling of results from comparable trials and thus the potential of meta-analysis to enhance the precision of the results from small trials was not realized. There was considerable variation in trial characteristics, such as patient characteristics, the type and the application of interventions, the overall care programs and so on. For example, there were 9 different external fixators as well as pins and plaster being compared with plaster cast immobilization in the group of 13 trials that compared external fixation with conservative treatment. This sort of variation as well as insufficient information on trial characteristics and incomplete and inadequate outcome assessment all hampered the interpretation of the results and their clinical applicability. Finally, information on resource use and costs was rarely available and, where provided, was minimal.

Discussion

These 2 reviews show that there is little robust evidence to guide the management of this everyday injury. However, it is evident that currently used treatments, both conservative and surgical, have the potential to cause harm and distal radius fractures can result in permanent impairment and pain. Therefore, there is an onus on professionals to take account of patient preferences and resource implications before embarking on any particular course of action.

There is a clear need for good-quality adequately-reported research addressing important questions through robust and ethical methods. Multi-center trials are feasible and are more likely to provide the generalisable evidence required.

In conclusion, we implore orthopaedic surgeons to consider these questions in managing distal radius fractures:

"If it was my mum then what sort of care would I wish for her?" and

"Is the care currently being provided acceptable for and to my mum?"

We hope the appreciation, perhaps heightened by the presentation of this paper, of the unsatisfactory nature of the current treatment and of the available evidence on which to base clinical decisions for these fractures will act a stimulus for action in this important clinical area.

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