ASERNIP-S

Australian Safety and Efficacy Register of New Interventional Procedures — Surgical

Rapid review

Clinical treatments for wrist ganglia

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Australian Safety & Efficacy Register of New Interventional Procedures — Surgical

The Royal Australasian College of Surgeons

ASERNIP-S rapid review

Disclaimer

This is a rapid systematic review in which the methodology has been limited in one or more areas to shorten the timeline for its completion. Thus, modifications have been made in at least one of the following areas: search strategy, inclusion criteria, assessment of study quality and data analysis. It is considered that these amendments would not significantly alter the overall findings of the rapid review when compared to a full systematic review.

The methodology used for the rapid review is described in detail, including the limits made for this particular topic. These limitations have been made possible mainly by restricting the specific clinical questions asked. These limits were applied following the requirements of the specific review topic, together with clinical guidance from a protocol surgeon.

Therefore, this rapid review is a limited evidence-based assessment that is based on a simple systematic search of studies published in the peer reviewed literature. As a result, this rapid review may be used to inform certain questions on the specific review topic.

Executive summary

Aim and scope

This rapid review aimed to assess the safety and effectiveness of clinical treatments for wrist ganglia compared with simple reassurance, through a limited systematic review of the literature.

Eligible studies were those that compared clinical treatment options for wrist ganglia to simple reassurance. Clinical treatment options included both surgical (excision) and non-surgical (aspiration, puncture etc.) techniques. Simple reassurance includes educating the patient of the nature of wrist ganglia and informing them that the masses are not cancerous and may resolve spontaneously. Studies are restricted to those conducted in adults (≥18 years) and the outcomes of interest were recurrence, resolution of symptoms (pain, discomfort or joint weakness), time off work/time to full recovery, and scarring. Specific safety outcomes of interest were complications/adverse effects, and damage to adjacent structures (nerves, joints or tendons, vascular).

Research papers were excluded if they: were case series/case report studies, included patients who had previous wrist ganglia treatment or had patients who were <18 years old. Recently published, well-conducted systematic reviews, rather than primary studies, were selected preferentially for inclusion in the review. If no suitable systematic reviews were identified, randomised controlled trials and pseudorandomised control trials were considered eligible for inclusion. Where the number of randomised or pseudorandomised trials was limited, nonrandomised comparative studies were also included.

Methods

The search strategy identified original articles published from January 1980 in the English language. Databases searched included: BMJ Clinical Evidence, the York Centre for Reviews and Dissemination, Cochrane Database of Systematic Reviews, Pubmed and EMBASE. Extended searching of internet websites, conference abstracts, handsearching of journals, and contacting of authors for unpublished data was not performed. The search terms utilised were: gangli* AND wrist, synovial cyst, (Ganglion (MeSH) or Gangli$ or Synovial cyst$) and wrist (MeSH).

No high quality systematic reviews or meta analyses were identified. Five randomised/pseudorandomised trials were retrieved. However none of these trials included reassurance as a comparator. In view of this, two comparative studies which utilised reassurance were retrieved for inclusion. Due to the scarcity of high level evidence, the five randomised/pseudorandomised trials were included as a means of examining the relative safety and effectiveness of the investigated clinical treatments. Nevertheless, it is important to note that only the comparative studies fulfilled the initial objective of comparing clinical wrist ganglia treatments to simple reassurance.

Key results and conclusions

From the search strategy, 276 potentially relevant articles were identified of which 33 were retrieved. A total of seven studies, including two randomised controlled trials (RCTs), three pseudorandomised controlled trials and two nonrandomised comparative studies were included for appraisal and inclusion in this rapid review. One was published in 2007, one in 2004, one in 2003, one in 2002, one in 1999 and two in 1997.

The findings and conclusions that were made based on the included evidence were:

1. There is discrepancy with regards to the relative recurrence rates of various treatments in the included studies. There is some evidence that surgical excision may be no better than aspiration or reassurance in preventing recurrence. However, several trials indicated that surgical excision appears to be significantly more effective in preventing ganglia recurrence compared to aspiration, at least in the short term (<6 months).
2. Patients treated with surgical excision were significantly more satisfied compared to those who received aspiration or reassurance, despite the fact that resolution of symptoms was lowest compared to aspiration and reassurance. Patient satisfaction appeared to be related to the extent of intervention and speed of resolution of the mass instead of symptom improvement.
3. Surgical excision is associated with higher complication rates and may cause more severe complications compared to aspiration and reassurance.
4. Surgical excision is associated with longer time off work.
5. Limitations of the current evidence base include lack of studies including reassurance as a comparator, short follow-up durations, small patient numbers, and insufficient measures of effectiveness. The best evidence currently available on the treatment of wrist ganglia are nonrandomised comparative studies. The published randomised and pseudorandomised trials lack methodological detail and sufficient outcome measures, and are not suitable to determine the relative effectiveness of clinical treatment against simple reassurance.
6. Based on the available evidence, wrist ganglia should be treated only if symptomatic. Surgical excision should be used as a last resort in view of the relatively high complication rates and the possibility that it does not confer enough benefit to warrant the higher risk. Due to the apparent patient value placed on intervention, aspiration may be considered as the preferred clinical treatment due to its lower complication rates and lower cost relative to excision.

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Introduction

Objective

To assess the safety and effectiveness of clinical treatments (both nonsurgical and surgical) for wrist ganglia compared with simple reassurance, through a limited systematic review of the literature.

Background

Condition

Ganglia are benign cysts that are found in various areas of the body, usually near a joint capsule, tendon or tendon sheath. Ganglion cysts contain a thick, clear, mucous-like fluid similar to the fluid found in joints. The ganglion capsule is formed from compressed stroma, with no cellular lining, and may be linked to the underlying joint capsule by a narrow channel that functions as a one-way valve (Burke et al 2003). Common sites for ganglia on the hand include the dorsal wrist, volar–radial wrist, dorsum of the distal interphalangeal joint and the proximal digital flexion crease. In some cases, ganglia can develop at an intra-osseous location where they adhere to tendons (for example, extensor tendons at the wrist) or can be associated with a carpal boss of the second and third carpometacarpal joints (Thornburg 1999). Wrist ganglia commonly develop at the dorsal and palmar–radial aspects of the wrist (Lowden et al 2005).

Most ganglion cysts are asymptomatic; however, some may cause pain, weakness, mobility problems or pressure neuropathy. In some cases, a lump may not be visible, and the only evidence of the occult ganglion is chronic pain (Thommasen et al 2006). A ganglion can cause chronic pain by placing pressure on adjacent nerves, while large ganglia can impede movement. Westbrook et al (2000) noted that of the 50 patients who attended a hand clinic with a ganglion diagnosis, 28% were concerned about possible malignancy, 38% attended for cosmetic reasons, and 26% sought pain relief.

Ganglia can occur in patients with a history of concurrent or chronic injury to the associated joint, and there is some evidence that ganglia are associated with internal derangement of joints (El-Noueam 1999). Some early theories of ganglia aetiology include synovial herniation, displaced germ cells that result in a dermoid cyst, direct growth of synovial tissue, and degenerated bursa or cysts. However, despite considerable efforts, the pathogenesis of wrist ganglia is still unknown (Beinz and Raphael 1999).

Clinical need

Ganglia are the most common benign soft tissue tumours of the hand and wrist, accounting for approximately 50% to 70% of soft tissue tumours in this part of the body (Limpaphayom and Wilairatana 2004). Ganglia can occur in patients of any age, with approximately 15% of

ganglion cysts occurring in patients younger than 21 years. Women are three times more likely to be affected than men (Tallia and Cardone 2003; Thommasen et al 2006).

Studies have shown that approximately 33% of dorsal ganglia and 45% of volar wrist ganglia resolve spontaneously within six years. Within 10 years, the rate of spontaneous resolution increases markedly to 51% and 63% for dorsal and volar ganglions, respectively (Burke et al 2003). Children have a substantially higher resolution rate of approximately 80% (Rozbruch et al 1998). Considering the high chance of spontaneous resolution, it is debatable whether wrist ganglia should be treated actively or excised, especially when the ganglion is asymptomatic.

Between July 2003 and June 2007, 2809 ganglion excision procedures were processed through Medicare Australia (Table 1), and the number of claims was relatively stable over this four-year period. Of these, 1997 procedures involved ganglia of the wrist (Medicare Benefits Schedule 2007). These figures do not include procedures by hospital doctors for public hospital patients and are therefore likely to underestimate the actual number of wrist ganglia excisions in Australia. The relevant Medicare Benefits Schedule (MBS) item descriptors do not restrict claims for treating wrist ganglia, and do not consider the severity or prevalence of pain, mobility issues or discomfort caused by a ganglion.

Table 1: MBS item numbers related to the treatment of wrist ganglia

MBS item number	Descriptor	MBS claims (July 2003–June 2007)
30106	GANGLION OR SMALL BURSA, excision of, not being a service associated with a service to which another item in this group applies	2006–2007: 559 2005–2006: 606 2004–2005: 699 2003–2004: 658
30107	GANGLION OR SMALL BURSA, excision of, not being a service associated with a service to which another item in this group applies	2006–2007: 850 2005–2006: 839 2004–2005: 927 2003–2004: 949
46494	GANGLION OF HAND, excision of, not being a service associated with a service to which another item in this group applies	2006–2007: 403 2005–2006: 384 2004–2005: 355 2003–2004: 406
46500	GANGLION OF DORSAL WRIST JOINT, excision of, not being a service associated with a service to which item 30106 or 30107 applies	2006–2007: 1112 2005–2006:1059 2004–2005: 1129 2003–2004: 1064
46501	GANGLION OF VOLAR WRIST JOINT, excision of, not being a service associated with a service to which item 30106 or 30107 applies	2006–2007: 716 2005–2006: 691 2004–2005: 715 2003–2004: 651
46502	RECURRENT GANGLION OF DORSAL WRIST JOINT, excision of, not being a service associated with a service to which item 30106 or 30107 applies	2006–2007: 101 2005–2006: 126 2004–2005: 136 2003–2004: 114
46503	RECURRENT GANGLION OF VOLAR WRIST JOINT, excision of, not being a service associated with a service to which item 30106 or 30107 applies	2006–2007: 68 2005–2006: 64 2004–2005: 77 2003–2004: 76
31200	TUMOUR (other than viral verrucae [common warts] and seborrheic keratoses), CYST, ULCER OR SCAR (other than a scar removed during the surgical approach to an operation), removal by surgical excision (other than shave excision) and suture from cutaneous or subcutaneous tissue or from mucous membrane, not being a service associated with, a service to which item 45200, 45203 or 45206 applies and not being a service to which another item in this group applies	2006–2007: 11926 2005–2006: 12532 2004–2005: 12939 2003–2004: 12987
31205	TUMOUR (other than viral verrucae [common warts] and seborrheic keratoses), CYST, ULCER OR SCAR (other than a scar removed during the surgical approach at an operation), lesion size up to and including 10 mm in diameter, removal by surgical excision (other than by shave excision) and suture from cutaneous or subcutaneous tissue or from mucous membrane, including excision to establish the diagnosis of tumours covered by items 31300 to 31335, where the specimen excised is sent for histological examination (not being a service to which item 30195 applies)	2006–2007: 285916 2005–2006: 319067 2004–2005: 298632 2003–2004: 297839

Source: Medicare Benefits Schedule, 2007

Treatment

Patient reassurance

Patient reassurance involves informing patients of the nature of wrist ganglia and reassuring them that the masses are not cancerous. A conservative treatment approach involving reassurance and observation, rather than excision, is usually appropriate, because most ganglia are asymptomatic, rarely of great clinical significance, benign, and generally resolve spontaneously (Ho et al 2001). Conservative treatment is particularly appropriate when the ganglion is asymptomatic, because a more invasive treatment increases the risk of complications and injury (Burke et al 2003).

Figure 1 shows the clinical decision-making pathway for diagnosing and treating wrist ganglia.

Nonsurgical treatments

Nonsurgical treatment options for wrist ganglia include wrist splints, massage, multiple puncture, traumatic destruction, hyaluronidase infiltration, hydrocortisone injection and aspiration. In the past, traumatic destruction (usually induced by firm massage or a sharp blow from a book) was used to treat wrist ganglia; however, this form of treatment is no longer practised because of the risk of injury, particularly from blunt trauma (Thornburg et al 1999).

Currently, the most commonly used nonsurgical treatment for wrist ganglia is aspiration, with or without steroid injection. Aspiration, using a wide-bore needle with a syringe, is a straightforward method of drawing out the ganglia contents with the needle and syringe (local anaesthetic is optional). Conventional aspiration has several variations, one of which involves hyaluronidase injection before aspiration. Hyaluronidase hydrolyses the ganglion contents, making it less viscous and able to flow freely into the syringe as the ganglion collapses (Otu 1992). Steroid (hydrocortisone) injection after aspiration is often used as well as a means of reducing inflammation, but its mechanism of action in the context of ganglia treatment is not well understood (Breidhal and Adler 1996).

Surgical excision

Surgical excision is considered the definitive treatment for wrist ganglia. It also has the highest risk of injury, because it may damage nerves or blood vessels, and cause scar tissue formation, tenderness and dysfunction. Typically, surgical excision is performed with local anaesthetic and the patient is discharged on the same day. During surgery, the ganglion is freed from the surrounding tissue and the dissection is carried down the stalk to its capsular attachment. Some surgeons cauterise the capsular resection margins to decrease the chance of recurrence; however, it is not clear how effective this procedure is (Thornburg 1999).

Arthroscopic excision of wrist ganglia uses a combination of suction punch and motorised shaver to resect the stalk of the cyst. The main benefit of this procedure is that the ganglion can be resected without the risk of a scar (which occurs after open resection) (Beinz and Raphael 1999). However, some researchers have noted that it may be difficult to visualise the ganglion and its stalk with this method (Thornburg 1999).

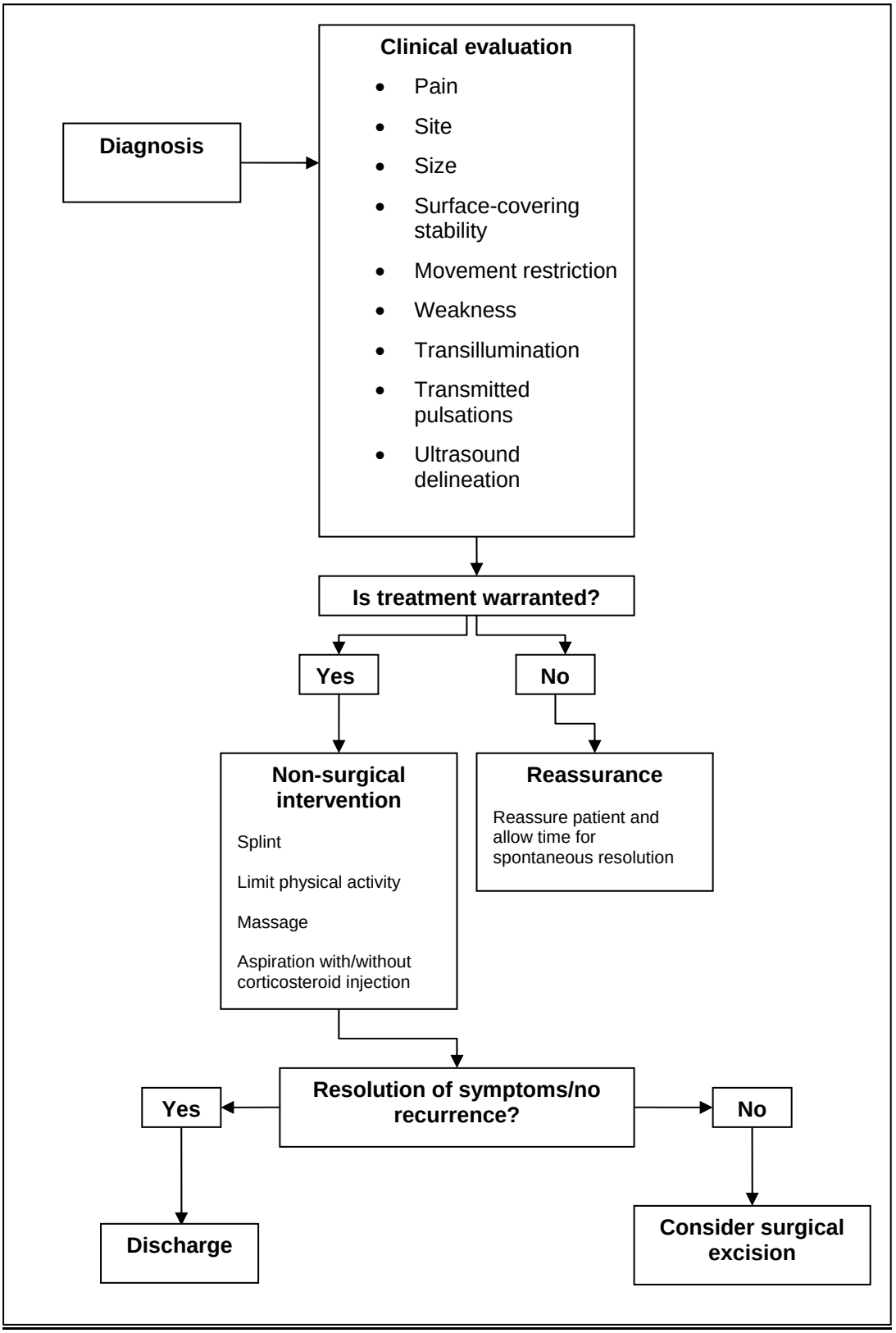

Figure 1: Clinical decision pathway for diagnosing and treating wrist ganglia

Research questions

The specific research questions that were addressed in this review are as follows:

- Are nonsurgical treatment options or surgical excision more effective for preventing recurrence of wrist ganglia than simple reassurance and allowing time for spontaneous resolution?
- Do nonsurgical treatments or surgical excision improve the symptoms of wrist ganglia (pain, weakness and mobility issues) more effectively than simple reassurance?
- Do the potential risks and complications of nonsurgical treatments or surgical excision for wrist ganglia outweigh the benefits?

Methodology

Inclusion criteria

Studies were selected for inclusion in this rapid review on the basis of the criteria outlined below.

Population

Studies of adult human patients (men and women aged 18 years and over) with asymptomatic or symptomatic wrist ganglia, and who had received no previous treatment, were included.

Intervention

Included studies used surgical excision (open or endoscopic) or nonsurgical therapies (splints, limiting of physical activity, or aspiration with or without corticosteroid injection) for treating asymptomatic or symptomatic wrist ganglia.

Comparator interventions

The main comparator for surgical excision and nonsurgical treatments was to reassure the patient and allow time for the spontaneous resolution of wrist ganglia without any clinical intervention.

Outcomes

Studies were included if they contained information on at least one of the following outcomes:

Effectiveness

- recurrence of ganglia
- resolution of pain, discomfort or joint weakness
- time off work or time to full recovery
- scarring.

Safety

- perioperative, postoperative and long-term complications or adverse effects
- damage to nerves, joints or tendons
- vascular damage.

Study design

Recently published, well-conducted systematic reviews, rather then primary studies were selected preferentially for including in the review and critical appraisal. Systematic reviews were defined as those studies that met all the following criteria as defined by Cook et al (1997):

1. Focused clinical question
2. Explicit search strategy
3. Use of explicit, reproducible and uniformly applied criteria for article selection
4. Critical appraisal of the included studies
5. Qualitative or quantitative data synthesis.

Where there were two or more systematic reviews with the same inclusion and exclusion criteria, the latest and most complete study was included. In addition, eligible randomised controlled trials (RCTs) published after the search date of the most recent systematic review were also included.

If no suitable systematic reviews on the topic were available, RCTs and pseudorandomised controlled trials were considered eligible for inclusion and critical appraisal. A study was deemed to be an RCT if the author(s) stated explicitly (usually by some variant of the term 'random' to describe the allocation procedure used) that the groups compared in the trial were established by random allocation (Higgins and Green 2005). Studies in which the method of allocation was known but was not considered strictly random (for example, alternation, date of birth and medical record number) were classified as pseudorandomised controlled trials (Higgins and Green 2005). Where no randomised and pseudorandomised controlled trials were identified, nonrandomised comparative studies were also included in the review.

When overlapping patient groups were reported in studies, only the paper quoting the most complete data set was used.

Publication date

Due to the relatively poor quality of literature on wrist ganglia published before 1980, literature considered eligible for including in this rapid review was restricted to studies published from January 1980 onwards.

Language of publication

Included studies were restricted to those published in English.

Literature search strategies

Databases searched

The following databases were searched:

- BMJ Clinical Evidence
- The York (UK) Centre for Reviews and Dissemination (CRD)
- The Cochrane Library
- PubMed
- EMBASE.

The review did not include extended searching of internet websites and conference abstracts, handsearching of journals, contacting authors for unpublished data or pearling references from retrieved articles.

Search terms

BMJ Clinical Evidence

Gangli* AND wrist, synovial cyst

York CRD and The Cochrane Library

Gangli*

PubMed and EMBASE

(Ganglion (MeSH) OR Gangli$ OR Synovial cyst$) AND Wrist (MeSH)

Note: * is a truncation character that retrieves all possible suffix variations of the root word; for example surg* retrieves surgery, surgical, surgeon, etc. In databases accessed via the Ovid platform, the truncation character is $.

Selection of studies

The reviewer (IL) applied the inclusion criteria to identify those studies potentially eligible for selection and appraisal based on their abstracts; these studies were retrieved as full text. The selection criteria were then applied fully to the retrieved studies to identify those to be appraised and included in the review. Full publications subsequently found not to meet the inclusion criteria were excluded and reasons for exclusion were documented.

Data extraction and appraisal of study methodology

Data from all included studies were extracted by one reviewer (IL) and checked by a second reviewer (PT) using standardised data extraction tables that were developed a priori. The studies included in the review were classified according to the National Health and Medical Research Council (NHMRC) hierarchy of evidence (see Table 2).

Table 2: National Health and Medical Research Council hierarchy of evidence

Level of evidence	Study design
I	Evidence obtained from a systematic review of all relevant randomised controlled trials
II	Evidence obtained from at least one properly designed randomised controlled trial
III-1	Evidence obtained from well-designed pseudorandomised controlled trials (alternate allocation or some other method)
III-2	Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomised, cohort studies, case-control studies, or interrupted time series with a control group
III-3	Evidence obtained from comparative studies with historical control, two or more single arm studies, or interrupted time series without a parallel control group
IV	Evidence obtained from case-series, either post-test or pre-test/post-test

Source: NHMRC 2000

Where systematic reviews were eligible for inclusion in the review, the methodology of these secondary studies was evaluated with respect to the following factors:

- Did the review ask a focused research question that incorporated the elements of the PICO (population, intervention, comparator, outcomes)?
- Were the inclusion and exclusion criteria of included studies clearly stated?
- Did the review use a clear and comprehensive search strategy?
- Did the review assess the validity of included studies, and if so which validity criteria were used?
- Was the analysis or synthesis of the results appropriate?
- Did the review include a summary of its main results, including a discussion of its strengths and limitations?

Where primary studies were eligible for inclusion in the review, the following criteria were used to appraise their methodology, where applicable:

- Were the objectives of the study clearly defined?
- Were the inclusion and exclusion criteria clearly described?
- Was there a clear description of the interventions used?
- Were the characteristics of patients included in the study clearly described?
- Were patients randomly assigned to intervention groups, and if so was the method of randomisation described?
- Was the randomised assignment of patients to intervention groups concealed from both patients and staff administering the study until recruitment was complete?
- Was there an attempt made to blind both patients, and staff responsible for measuring outcomes of the intervention, to the interventions patients received?
- Were the number of patients who withdrew or dropped-out of the study reported, and the characteristics of these patients described?
- Were the main outcomes of interest adequately reported?
- Were point estimates and measures of variability presented for the primary outcome measures?

Non-randomised studies were also assessed for other features of study design or execution that may have introduced bias, such as comparability of patient groups at baseline, method of patient selection and comparability of timing of outcome assessment.

One reviewer (IL) appraised the studies, which were checked by the second reviewer (PT). Any differences were resolved through discussion.

Results

From the search strategy, 276 potentially relevant articles were identified of which 33 were retrieved. The retrieved papers consisted of primary research on treatments for wrist ganglia; however no systematic reviews were identified. One Cochrane systematic review protocol was identified (Vroon et al 2007); however the estimated date of completion for this review is not known. In total, 26 retrieved articles were excluded (mainly due to low-quality evidence [Level IV intervention evidence]) and these are listed in Appendix A.

A total of seven studies, including two RCTs (Jagers op Akkerhuis et al 2002; Limpaphayom and Wilairatana 2004), three pseudorandomised controlled trials (Paul and Sochart 1997; Stephen et al 1999; Varley et al 1997) and two nonrandomised comparative studies (Dias and Buch 2003; Dias et al 2007) were included for appraisal and inclusion in this rapid review. It is important to note that only the comparative studies included reassurance as one of the comparators. Therefore these studies will be the main focus of this rapid review.

Due to the scarcity of evidence, the remaining studies were selected for inclusion as a means of examining the relative safety and effectiveness between clinical treatments. All three pseudorandomised controlled trials compared variations of one treatment: aspiration (Paul and Sochart 1997; Stephen et al 1999; Varley et al 1997). Neither RCT included reassurance as a comparator, while two studies (one RCT and one pseudorandomised controlled trial) included patients with ganglia at sites other than the wrist (Paul and Sochart 1997; Jagers op Akkerhuis et al 2002), including the foot or hand. Although it would have been ideal to exclude the results for non-wrist ganglia, this was not possible because the results from these studies were pooled by the investigators, and there were insufficient data to isolate the desired information. Fortunately, the proportion of patients who had ganglia in other sites was relatively small (<10%) in the cohort analysed by Paul and Sochart (1997). However, over 17% ganglia were located on the foot in one arm (excision) of the cohort studied by Jagers op Akkerhuis et al (2002). This has a substantial effect on the validity of the results for the purposes of this rapid review. Evidence tables of included studies are presented in Appendix B. A summary of the key characteristics of the included studies is presented within Table 3.

Table 3: Summary of Included Studies

Study	Level of Evidence	Study Type	Interventions	Number of patients	Length of Follow-up
Limpaphayom and Wilairatana (2004)	II	RCT	Surgical excision Aspiration with steroid injection	11 13	6 months
Jagers op Akkerhuis et al (2002)	II	RCT	Surgical excision Hyaluronidase, aspiration and puncture	50 50	6 months
Paul and Sochart (1997)	III-1	Pseudo-RCT	Aspiration with steroid injection Aspiration with methylprednisolone	35 35	At least 2 years
Stephen et al (1999)	III-1	Pseudo-RCT	Aspiration alone Aspiration and multiple puncture	65 54	1 year
Varley et al (1997)	III-1	Pseudo-RCT	Aspiration alone Aspiration with steroid injection	42 43	~2 years
Dias and Buch (2003)	III-2	Comparative	Surgical excision Aspiration Reassurance	79 38 38	5 years
Dias et al (2007)	III-2	Comparative	Surgical excision Aspiration Reassurance	103 78 55	6 years

Studies included in the review

Surgical excision versus aspiration versus reassurance

Nonrandomised comparative studies

Both nonrandomised comparative studies investigated the relative effectiveness of surgical excision, aspiration and reassurance in the treatment of wrist ganglia (Dias and Buch 2003; Dias et al 2007).

Dias and Buch (2003) ensured that all treatment groups were comparable for age, sex and initial symptoms (pain, weakness, stiffness and seriousness). However, the patients recruited for the treatment arms were more likely to be slightly older and female compared with those who were not recruited. It is also interesting to note that patients who had excision were twice as likely to consider their ganglion unsightly. To assess the existence of bias, additional comparisons were made between patients who were recruited or not recruited, and those who were followed up or not followed up. Treatment allocation was determined by surgeon preference. Overall, approximately 14% of patients (25 of 176 patients) were lost to follow-up; dropout rates for each treatment group were not reported. In this study, both effectiveness and safety outcomes were adequately reported.

Dias et al (2007) investigated selection bias between those recruited and not recruited, between treatment groups, and between those followed up and those lost to follow-up. There is a possibility of patient overlap with Dias and Buch (2003), because both studies were done at the same hospital and had the same lead author. Of the 283 patient who consented, 232

responded at 1 year, 133 after 2 years and 200 at 6 years. Analysis revealed that responders were more affected by pain (P=0.002) compared with those who did not respond. The substantial losses to follow-up (47/236 patients, 20%) in this study may have effected the results. Unfortunately, drop out rates for each treatment group was not reported. Safety and effectiveness outcomes were adequately described.

Surgical excision versus aspiration

Randomised controlled trials

Two RCTs compared surgical excision with aspiration (Jagers op Akkerhuis et al 2002; Limpaphayom and Wilairatana 2004). Jagers op Akkerhuis et al (2002) did not specify any inclusion or exclusion criteria; demographic data for both treatment groups were recorded (age, sex, dominance of hand, ganglion size and location, and symptoms [pain and loss of strength]), but no statistical tests were performed to determine if both groups were comparable. Of the 89 patients, 8/46 (17.4%) patients in the excision group and 5/43 (11.6%) patients in the aspiration group had foot ganglia. Patients were only followed up for six months, which may have skewed the results in favour of surgical excision, because recurrence may take longer than six months to occur. Intention to treat analysis was not done and no safety outcomes were presented. Due to the relatively high proportion of patients with foot ganglia, the validity of this study in this rapid review is substantially compromised and its results should be viewed with caution.

Limpaphayom and Wilairatana (2004) performed a RCT to compare surgical excision, and aspiration combined with steroid injection and wrist immobilisation for treating dorsal wrist ganglia. The inclusion and exclusion criteria for this trial were clearly stated, and patient groups were matched for sex, ganglion size and location and symptoms (pain and weakness). Patients were randomly allocated using the sealed envelope method, no details were provided regarding allocation concealment. A power calculation determined that a sample size of 11 in each group was required if the success rate of surgical excision was set to 95%, and a 30% difference in success was determined clinically acceptable (α=0.05, β=0.10). A total of 28 patients were initially recruited, however only 24 patients were available for follow-up at six months after treatment. Similar to Jagers op Akkerhuis et al (2002), the follow-up duration may not have been long enough to determine the true recurrence rate after excision. An intention to treat analysis was not done.

Aspiration and variants

Pseudorandomised controlled trials

Three pseudorandomised controlled trials investigated the effectiveness of aspiration and its variants, namely aspiration with the use of hyaluronidase (Paul and Sochart 1997), aspiration with steroid injection (Varley et al 1997), and aspiration combined with multiple punctures (Stephen et al 1999).

Paul and Sochart (1997) used a simple pseudo-randomisation technique (alternate allocation) to compare the effectiveness of conventional aspiration combined with steroid injection, and prior hyaluronidase injection followed by aspiration and steroid injection. Patients were

recruited solely on the presence of a ganglion in the wrist (94.3%) or hand (5.7%) and patients were allocated based on first attendance on an alternate basis. No exclusion criteria were used during patient recruitment. Statistical comparison between the treatment groups revealed no differences in sex balance, hand dominance or site of the ganglia. However, the authors did not ensure that initial symptoms, such as pain or weakness, or ganglia size, were comparable between the treatment groups. All procedures were conducted by one surgeon and all patients were followed up for at least two years.

The pseudorandomised controlled trial by Varley et al (1997) compared conventional aspiration with aspiration accompanied by steroid injection. The sole inclusion criterion was the presence of a wrist ganglion for greater than three months; however, no exclusion criteria were used. An intention to treat analysis was not done. Patients were allocated to treatment groups according to hospital number. There was no evidence that patients had comparable symptoms related to the presence of the wrist ganglion. However, patients were comparable in age, sex and ganglion characteristics (site, size and duration). A total of 28/133 (25%) patients were lost to follow-up. No safety outcomes were presented, making it difficult to determine whether complications occurred or whether these data were omitted from publication.

Stephen et al (1999) randomised 119 ganglia to aspiration or aspiration with multiple puncture. No inclusion or exclusion criteria were used, other than the presence of a wrist ganglion. Patients were allocated based on their hospital number, odd numbers underwent multiple puncture with aspiration while even numbers underwent aspiration alone. No tests were conducted to ensure demographic comparability between groups. A total of 14/65 (21.5%) patients in the aspiration group and 13/54 (24.1%) patients in the aspiration with multiple puncture were lost to follow-up. An intention to treat analysis was not done, and no safety outcomes were presented.

Summary of review findings

Overview

Two RCTs (Jagers op Akkerhuis et al 2002; Limpaphayom and Wilairatana 2004), three pseudorandomised controlled trials (Paul and Sochart 1997; Varley et al 1997; Stephen et al 1999) and two nonrandomised comparative studies (Dias and Buch 2003; Dias et al 2007) were identified for inclusion in this rapid review.

The nonrandomised comparative studies (Dias and Buch 2003; Dias et al 2007) were generally well-designed. Both studies detailed their objectives clearly with good descriptions of the interventions utilised. However, both studies did not utilise any inclusion criteria. Patient characteristics were adequately described and tests were conducted to identify any selection bias in each treatment group. Patients lost to follow-up were clearly reported and were compared with those who had complete follow-up to identify any differences. The main study outcomes were described clearly and included other measures of effectiveness (pain, weakness, stiffness, unsightliness) besides ganglion recurrence rates.

The quality of the randomised and pseudorandomised controlled trials was relatively low. None of the randomised trials stated the method of randomisation clearly; however patient demographics appeared to be comparable between the treatment groups in each of these studies. Most randomised and pseudorandomised trials utilised a simple inclusion criteria (presence of ganglia) with no exclusion criteria (Jagers op Akkerhuis et al 2002; Paul and Sochart 1997; Stephen et al 1999; Varley et al 1997). In addition to this, randomised and pseudorandomised trials lacked details on safety outcomes and failed to provide any other measures of effectiveness besides recurrence rates.

This aim of this rapid review was to determine whether active clinical treatment (nonsurgical and surgical) of wrist ganglia reduces symptoms and results in a lower recurrence rate with acceptable risk, compared with simple reassurance. Both nonrandomised comparative trials included reassurance as a comparator, and therefore provided the bulk of evidence on the relative effectiveness of reassurance compared with active treatment.

None of the randomised and pseudorandomised controlled trials included in the review used reassurance as a comparator. This substantially limits their usefulness for this rapid review and will not provide any useful insights into the relative effectiveness or safety between clinical treatment and reassurance. Nevertheless, these trials were included for discussion as they do provide some insight into the comparable efficacy of various aspiration treatments and surgical excision.

Safety

Surgical excision versus aspiration

Two RCTs examined the outcomes of surgical wrist ganglion excision. One did not observe any complications (Jagers op Akkerhuis et al 2002), while the other did not report on safety outcomes (Limpaphayom and Wilairatana 2004).

One nonrandomised comparative study noted that, after surgical excision, complication rates were significantly higher when compared with aspiration and reassurance (P=0.003) (Dias and Buch 2003). Dias et al (2007) observed complication rates that were almost three times greater for surgical excision (8%) compared with aspiration (3%), but this was not statistically significant (Dias et al 2007). In addition to higher complication rates, some trials showed that surgical excision caused more severe complications. One trial (Dias and Buch 2003) observed a case of radial artery damage and numbness in the distribution of the palmar cutaneous branch of the median nerve. Meanwhile, the surgical complications observed by Dias et al (2007) included three cases of numbness, four cases of tender scar formation, and one case of keloid formation after excision.

Overall, surgical excision appears to be associated with higher complication rates and has the potential to cause more severe complications relative to aspiration.

Aspiration and variants

Aspiration of wrist ganglia was used as one of the comparators in all included randomised and pseudorandomised controlled trials. Only one study noted some minor complications for this method of treatment (Paul and Sochart 1997). In this study, two patients[1] (3%) experienced superficial infection, while two other patients (3%; hyaluronidase, aspiration and steroid injection group) developed a mild localised rash and depigmentation (Paul and Sochart 1997). The remaining trials either did not observe any complications (Limpaphayom and Wilairatana 2004) or did not report any safety outcomes (Stephen et al 1999; Jagers op Akkerhuis et al 2002; Varley et al 2007).

The two nonrandomised comparative studies reported complication rates of 5% (Dias and Buch 2003) and 3% (Dias et al 2007) after aspiration. However, the nature of these complications was not disclosed, making it difficult to assess their severity.

Therefore, the evidence indicates that aspiration is a relatively safe treatment for wrist ganglia (compared with excision), with complication rates ranging from 0% to 5%, and with no apparent serious adverse effects following treatment. However, more trials are needed as the complications observed are not adequately described in the included trials. It is possible that this information is contained within case-series studies that were not included for discussion in this rapid review.

Effectiveness

Surgical excision versus aspiration versus reassurance

The comparative study by Dias and Buch (2003) reported that similar recurrence rates were observed following surgical excision, aspiration and reassurance. However, in another study (Dias et al 2007), surgical excision had a lower recurrence rate compared with both aspiration and reassurance (P=0.02). The reason for this discrepancy is unclear.

[1] One patient from the hyaluronidase + aspiration + methylprednisolone injection group and one patient from the aspiration + methylprednisolone injection group.

Dias and Buch (2003) reported that, regardless of treatment type, the proportion of patients experiencing pain and stiffness decreased. However the persistence of joint weakness following treatment seems to indicate that the ganglion was not the cause of this symptom, which may in fact have been due to an underlying problem that resulted in both ganglia formation and development of joint weakness (Dias and Buch 2003). Similarly, Dias et al (2007) observed that the incidence of pain decreased regardless of the treatment type. However, joint weakness was *marginally* higher in excision patients compared with those who underwent aspiration or reassurance (P=0.08). Regarding joint stiffness, the proportion of patients remained the same or marginally increased over the six-year follow-up period for all treatment groups (Dias et al 2007).

Two trials reported on time off work and both noted that patients who had surgical excision required significantly more time off work compared with those who received aspiration or reassurance (Dias and Buch 2003; Dias et al 2007).

Dias and Buch (2003) noted that at two years after treatment, the proportion of patients satisfied with surgical excision, aspiration and reassurance was similar (89%, 67%, and 81% respectively; P=0.06). At five years after treatment, patient satisfaction continued to be similar between all three treatment groups (P=0.87). Conversely, Dias et al (2007) reported that patients who received simple reassurance were less satisfied with their treatment when compared with those patients who received surgical excision or aspiration (P<0.0001). However, patient evaluation measure scores were similar across all treatment groups, indicating that, despite the fact that patients who received reassurance expressed lower satisfaction with their treatment, there was no difference in their perception of symptoms and disability compared with those treated with surgical excision or aspiration.

Surgical excision versus aspiration

When surgical excision was compared with aspiration combined with steroid injection and wrist immobilisation, Limpaphayom and Wilairatana (2004) reported that surgical excision had a significantly higher success rate[2] (P=0.047). Similarly, Jagers op Akkerhuis et al (2002) reported that patients treated with surgical excision had significantly higher success rates compared with patients treated with hyaluronidase injection with aspiration (P<0.0001). Therefore, both RCTs demonstrated that surgical excision is a more effective treatment for wrist ganglia compared with aspiration for preventing recurrence (either in combination with multiple punctures or steroid injection). However, it is important to note that Limpaphayom and Wilairatana (2004) had very small patient numbers and both trials had a substantially shorter follow-up period (six months) compared with the included pseudorandomised controlled trials and nonrandomised comparative studies (ranging from one year to six years).

Aspiration and variants

Aspiration has long been considered one of the main treatment options for wrist ganglia, and various modifications to the technique (such as steroid injections and needle puncture) have been introduced to increase the treatment's effectiveness. One randomised trial (Varley et al

[2] Measured in terms of recurrence rates

1997) reported that the combination of aspiration with steroid (methylprednisolone) injection did not confer any significant benefit compared with aspiration alone. Meanwhile, Stephen et al (1999) reported no significant benefit in resolution rates when aspiration was combined with multiple needle puncture compared with aspiration alone. Conversely, the combination of prior hyaluronidase injection followed by aspiration and steroid instillation resulted in significantly better results compared with aspiration in combination with steroid instillation (P=0.0051) (Paul and Sochart 1997).

Conclusions

Seven studies were identified as eligible for inclusion in the rapid review, including two RCTs, three pseudorandomised controlled trials and two nonrandomised comparative studies.

Conclusions based on the results of the review are summarised below.

1. Three studies (two randomised trials, one nonrandomised comparative study) indicated that surgical excision appears to be significantly more effective in preventing ganglia recurrence compared with aspiration, at least in the short-term (<6 months). Conversely, one comparative study found surgical excision to be no more effective than aspiration or reassurance in the long-term.
2. The use of hyaluronidase before aspiration resulted in significantly lower recurrence rates compared with aspiration alone in the short-term (six months).
3. One comparative study reported that patients treated with surgical excision were significantly more satisfied compared with patients treated with aspiration or those who were reassured, despite the fact that the resolution of symptoms was lowest when compared with aspiration and reassurance. Patient satisfaction appeared to be related to the extent of intervention and perhaps the speed of resolution.
4. Surgical excision of wrist ganglia had significantly higher complication rates and may cause more severe complications compared with aspiration and reassurance. Surgical excision was also associated with a significantly longer time off work, which may have economic consequences.

The validity of results presented by RCTs investigating the effectiveness of surgical excision compared with aspiration was compromised by relatively small patient numbers and short follow-up periods. In addition, the retrieved randomised and pseudorandomised controlled trials on wrist ganglia treatment did not adequately measure the effectiveness of the treatments investigated. The resolution of symptoms, such as pain and weakness, should be considered for a more complete measure of effectiveness. There are currently no RCTs that have evaluated active treatment compared with simple reassurance.

Based on the evidence presented in this rapid review, active clinical treatment should only be considered if the ganglion is symptomatic. If the ganglion is asymptomatic, active treatment, particularly excision, should be withheld. Surgical excision should only be used as a last resort for symptomatic ganglia in view of the complication rates and the possibility that it does not confer enough benefit to warrant its higher risk. It is also interesting to note is the value that patients attach to intervention. One study noted that despite having similar outcomes, patients who underwent active clinical treatment (excision or aspiration) were significantly more satisfied with their treatment. Based on this, perhaps it is worth considering aspiration as the preferred clinical treatment due to its potentially lower complication rates and lower cost relative to surgical excision.

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Appendix A: Excluded studies

Case-series

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Comment/opinion

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Appendix B: Evidence tables

Table B1: Evidence table of included nonrandomised comparative studies investigating treatment of wrist ganglia

<table>
<tr><th>Study details</th><th>Aim and intervention</th><th>Study design and inclusion/exclusion criteria</th><th>Study population</th><th>Results</th></tr>
<tr>
<td>Dias and Buch (2003)

Glenfield Hospital, University Hospitals of Leicester, Leicester, UK and Royal Oldham Hospital, Oldham, UK.</td>
<td>Surgical excision versus aspiration versus reassurance

Surgical excision
Procedure details:
Ganglion excised along with connecting stalk, which is followed to the joint.

Aspiration
Procedure details:
Not stated. Authors noted that aspiration in combination with steroid infiltration was considered to represent aspiration.

Reassurance
Procedure details:
Simple reassurance and watchful waiting</td>
<td>Level of evidence (NHMRC):
III-2 intervention

Duration of follow-up:
Questionnaire sent at 1, 2 and 5 years after treatment.

Patients who responded no reoccurrence of ganglion at 2 years but did not respond at 5 years are assumed to have experienced recurrence.

Losses to follow-up:
25

Study period:
1993 to 1995

Procedural team details:
Surgical excisions were done by several senior and junior surgeons. Clinicians' preference determined the method of treatment.

Inclusion criteria:
Patients with palmar wrist ganglia

Exclusion criteria:
Not stated</td>
<td>Sample size:
Surgical excision: 79
Aspiration: 38
Reassurance: 38

Age (median years) [SD]:
Surgical excision: 43.4 [1.7]
Aspiration: 48.2 [2.5]

Sex mix (M/F): 57/98

Site of ganglia:
Palmar wrist ganglia

Investigation of selection bias:
a) Patients recruited and not recruited
<table>
<tr><th></th><th>Not recruited</th><th>Recruited</th><th>P-value</th></tr>
<tr><td>Age</td><td>37.4</td><td>45.1</td><td>0.01</td></tr>
<tr><td>SD,SE</td><td>17.6, 2.7</td><td>17.6, 1.3</td><td></td></tr>
<tr><td>Sex</td><td>26 m:25 f</td><td>62 m: 114 f</td><td>0.04</td></tr>
</table>
1) SE: standard error.

b) Between treatment groups
<table>
<tr><th></th><th>Excise</th><th>Aspirate</th><th>Reassure</th><th>P-value</th></tr>
<tr><td>Age</td><td>37.4</td><td>48.2</td><td>40.9</td><td>0.11</td></tr>
<tr><td>SE</td><td>1.7</td><td>2.5</td><td>2.4</td><td></td></tr>
<tr><td>Sex</td><td>44 m:63 f</td><td>22 m:35 f</td><td>20 m:38 f</td><td>0.70</td></tr>
<tr><td>Pain</td><td>84%</td><td>92%</td><td>83%</td><td>0.46</td></tr>
<tr><td>Weakness</td><td>26%</td><td>27%</td><td>24%</td><td>0.97</td></tr>
<tr><td>Stiffness</td><td>10%</td><td>5%</td><td>10%</td><td>0.72</td></tr>
<tr><td>Unsightliness</td><td>43%</td><td>22%</td><td>21%</td><td>0.02</td></tr>
</table>
</td>
<td>a) Comparison of three treatment methods
<table>
<tr><th></th><th>Excise</th><th>Aspirate</th><th>Reassure</th><th>P-value</th></tr>
<tr><td>Recurrence/ Persistence (%)</td><td>42%</td><td>47%</td><td>47%</td><td>0.78</td></tr>
<tr><td>Final</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Pain (%)</td><td>16</td><td>18</td><td>28</td><td>0.37</td></tr>
<tr><td>Weakness (%)</td><td>23</td><td>25</td><td>25</td><td>0.95</td></tr>
<tr><td>Stiffness (%)</td><td>10</td><td>11</td><td>9</td><td>0.98</td></tr>
<tr><td>Unsightliness</td><td>7</td><td>4</td><td>22</td><td>0.02</td></tr>
<tr><td>Satisfaction</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Fifth year (%)</td><td>83</td><td>83</td><td>88</td><td>0.87</td></tr>
<tr><td>Second year (%)</td><td>89</td><td>67</td><td>81</td><td>0.06</td></tr>
<tr><td>Complications (%)</td><td>20</td><td>5</td><td>0</td><td>0.003</td></tr>
<tr><td>PEM hand disability</td><td>14.1</td><td>17.1</td><td>15.5</td><td>0.83</td></tr>
<tr><td>SE (PEM)</td><td>2.5</td><td>4.3</td><td>4.3</td><td></td></tr>
<tr><td>Time off work (days)</td><td>14.1</td><td>3.5</td><td>0.0</td><td>0.000</td></tr>
<tr><td>SE (time off work)</td><td>1.96</td><td>1.5</td><td></td><td></td></tr>
</table>
1) PEM: Patients evaluation measure. Assesses hand symptoms.
2) Complications include wound infection, neuroma formation, hypertrophic scar, numbness in the distribution of palmar cutaneous branch of the median nerve and radial artery damage in one patient.</td>
</tr>
</table>

Table B1 *continued*: Evidence table of included nonrandomised comparative studies investigating treatment of wrist ganglia

c) Patients followed up and not followed up

	Not followed up (*n*=25)	Followed up (*n*=151)	*P*-value
Age	39.6	46.0	0.091
SD,SE	18.4, 3.7	17.4, 1.4	
Sex	13 m:12 f	49 m:102 f	0.58
Initial symptoms			
Pain	84%	86%	0.76
Weakness	24%	26%	0.53
Stiffness	12%	9%	0.42
Unsightliness	28%	34%	0.59
Treatment			
Excision	14%	86%	
Aspiration	7%	93%	
Reassurance	16%	84%	0.46

1) SD: standard deviation.
2) SE: standard error.

b) Comparison of cases with and without recurrence/persistence

	No ganglion (*n*=84)	Ganglion present (*n*=67)	*P*-value
Age	47.7	43.8	0.18
SD,SE	17.4, 1.9	17.2, 2.1	
Sex	27 m:67 f	22 m:45 f	0.93
Initial			
Pain	88%	85%	0.57
Weakness	27%	25%	0.75
Stiffness	10%	7%	0.55
Unsightliness	31%	37%	0.47
Final			
Pain	9%	31%	0.003
Weakness	20%	28%	0.35
Stiffness	5%	16%	0.04
Unsightliness	5%	16%	0.04
Complications	7%	16%	0.07
Satisfaction	85%	84%	0.91
PEM	8.8	22.3	0.000
SD,SE (PEM)	14.4, 1.8	24.0, 3.3	
Time off work	9.5 days	6.4 days	0.19
SD,SE (time off work)	16.6,1.9	10.9,1.3	

1) PEM: patients' evaluation measure.
2) SD: standard deviation.
3) SE: standard error.

Table B1 *continued*: Evidence table of included nonrandomised comparative studies investigating treatment of wrist ganglia

<table>
<tr><th>Study details</th><th>Aim and intervention</th><th>Study design and inclusion/exclusion criteria</th><th>Study population</th><th>Results</th></tr>
<tr>
<td>Dias et al (2007)

Glenfield Hospital, Leicester, Leicester, UK</td>
<td>Surgical excision versus aspiration versus reassurance.

Surgical excision
Procedure details:
Ganglion excised along with its stalk.

Aspiration
Procedure details:
Not stated. Includes patients treated with aspiration and steroid infiltration as well.

Reassurance
Procedure details:
Simple reassurance and watchful waiting.</td>
<td>Level of evidence (NHMRC): III-2 intervention

Duration of follow-up:
Questionnaire sent at 1, 2 and 6 years after treatment.

Patients who responded no reoccurrence of ganglion at 2 years but did not respond at 6 years are assumed to have experienced recurrence.

Losses to follow-up:
Of 283 patients who consented, 232 responded at 1 year, 133 at 2 years, and 200 at 6 years.

Study period:
Not stated

Procedural team details:
Surgical excisions were done by several senior and junior surgeons.

Inclusion criteria:
Patients with palmar wrist ganglia

Exclusion criteria:
Not stated</td>
<td>Sample size:
Surgical excision: 103
Aspiration: 78
Reassurance: 55

Age (median years) [SD]:
Surgical excision: 35.3 [1.5]
Aspiration: 39 [1.9]
Reassurance: 34.3 [1.7]

Sex mix (M/F):
Surgical excision: 36/67
Aspiration: 22/56
Reassurance: 14/41

Site of ganglia:
Dorsal wrist

Investigation of selection bias:
a) Patients recruited and not recruited
<table>
<tr><th></th><th>Recruited (n=283)</th><th>Not recruited (n=104)</th><th>P-value</th></tr>
<tr><td>Age</td><td>35.6</td><td>29.6</td><td>0.002</td></tr>
<tr><td>SE</td><td>0.9</td><td>1.3</td><td></td></tr>
<tr><td>Sex</td><td>82m:201f</td><td>33m: 71f</td><td>0.6</td></tr>
</table>
b) Between treatment groups
<table>
<tr><th></th><th>Excise (n=123)</th><th>Aspirate (n=100)</th><th>Reassure (n=60)</th><th>P-value</th></tr>
<tr><td>Age</td><td>34.9</td><td>37.7</td><td>33.5</td><td>0.19</td></tr>
<tr><td>SE</td><td>1.4</td><td>1.6</td><td>1.7</td><td></td></tr>
<tr><td>Sex</td><td>43 m:80 f</td><td>25 m:75 f</td><td>14 m:46 f</td><td>0.15</td></tr>
<tr><td>Pain</td><td>67.5%</td><td>59%</td><td>58.3%</td><td>0.32</td></tr>
<tr><td>Weakness</td><td>23.6%</td><td>18%</td><td>23.3%</td><td>0.56</td></tr>
<tr><td>Stiffness</td><td>8.9%</td><td>13%</td><td>15%</td><td>0.43</td></tr>
<tr><td>Unsightliness</td><td>28.5%</td><td>31%</td><td>16.7%</td><td>0.12</td></tr>
<tr><td>Seriousness</td><td>13.8%</td><td>15%</td><td>21.7%</td><td>0.38</td></tr>
</table>
1) SE: standard error.</td>
<td>a) Results of surgical excision, aspiration and reassurance
<table>
<tr><th></th><th>Excision (n=103)</th><th>Aspiration (n=78)</th><th>Reassurance (n=55)</th><th>P-value (analysis of variance)</th></tr>
<tr><td>Recurrence or persistence</td><td>39%</td><td>58%</td><td>58%</td><td>0.02</td></tr>
<tr><td>Initial symptoms</td><td>n=107</td><td>n=81</td><td>n=44</td><td></td></tr>
<tr><td>Pain</td><td>78%</td><td>73%</td><td>77%</td><td>0.73</td></tr>
<tr><td>Weakness</td><td>27%</td><td>22%</td><td>30%</td><td>0.62</td></tr>
<tr><td>Stiffness</td><td>10%</td><td>16%</td><td>21%</td><td>0.23</td></tr>
<tr><td>Unsightliness</td><td>33%</td><td>38%</td><td>23%</td><td>0.21</td></tr>
<tr><td>Final review</td><td>n=103</td><td>n=78</td><td>n=55</td><td></td></tr>
<tr><td>Pain</td><td>27%</td><td>29%</td><td>29%</td><td>0..94</td></tr>
<tr><td>Weakness</td><td>34%</td><td>24%</td><td>18%</td><td>0.08</td></tr>
<tr><td>Stiffness</td><td>15%</td><td>13%</td><td>13%</td><td>0.69</td></tr>
<tr><td>Unsightliness</td><td>13%</td><td>9%</td><td>13%</td><td>0.71</td></tr>
<tr><td>Satisfaction</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2 and 6 year</td><td>83%</td><td>81%</td><td>53%</td><td><0.0001</td></tr>
<tr><td>Complications</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2 and 6 year</td><td>8%</td><td>3%</td><td>0%</td><td></td></tr>
<tr><td></td><td>3 numbness, 4 scar tender, 1 keloid</td><td>2 scar tender</td><td></td><td></td></tr>
<tr><td>PEM (SE)</td><td>19.2 (2.1)</td><td>13.8 (2.2)</td><td>15.0 (3.6)</td><td>0.21</td></tr>
<tr><td>Time off work (days) (SE)</td><td>10.9 (1.3)</td><td>3.2 (1.5)</td><td>1.3</td><td><0.0001</td></tr>
<tr><td>SE (time off work)</td><td>1.3</td><td>1.5</td><td>1.0</td><td></td></tr>
</table>
1) PEM: patients' evaluation measure.
2) SE: standard error.</td>
</tr>
</table>

Table B1 *continued*: Evidence table of included nonrandomised comparative studies investigating treatment of wrist ganglia

c) Patients followed up and not followed up

	Followed up (*n*=236)	Not followed up (*n*=47)	*P*-value
Age	36.3	31.8	0.06
SE	1	1.9	
Sex	72 m:164 f	10 m:372 f	0.6
Initial symptoms			
Pain	58.5%	83%	0.002
Weakness	20.3%	27.7%	0.27
Stiffness	11.4%	12.8%	0.80
Unsightliness	27.1%	25.5%	0.82
Seriousness	15.7%	17%	0.82
Treatment			
Excision	43.6%	42.6%	0.08
Aspiration	33.1%	46.8%	
Reassurance	23.3%	10.6%	

1) SE: standard error.

b) Comparison of patient with and without a recurrent/persistent ganglion

	No ganglion (*n*=119)	Ganglion present (*n*=117)	*P*-value
Age	37.2	35.5	0.40
SE	1.4	1.5	
Sex	41 m:78 f	31 m:86 f	0.18
Initial symptoms			
Pain	55%	63%	0.23
Weakness	16%	25%	0.09
Stiffness	8%	15%	0.06
Unsightliness	26%	28%	0.71
Final review			
Pain	14%	43%	<0.0001
Weakness	24%	30%	0.34
Stiffness	7%	23%	<0.0001
Unsightliness	3%	21%	<0.0001
Satisfaction	83%	68%	0.005
PEM	9.4	24.1	<0.0001
SE (PEM)	1.2	2.4	
Time off work	6.1 days	6.3 days	0.91
SE (time off work)	1	1.3	

1) PEM: patients' evaluation measure.
2) SE: standard error.

c) Resolution of presenting symptoms

	Excision (*n*=88)	Aspiration (*n*=68)	Reassurance (*n*=44)	*P*-value
Pain	63%	71%	74%	0.55
Weakness	32%	56%	56%	0.34
Stiffness	63%	78%	83%	0.64
Unsightliness	86%	87%	100%	0.62

Table B2: Evidence table of included randomised controlled trials investigating treatment of wrist ganglia

<table>
<tr><th>Study details</th><th>Aim and intervention</th><th>Study design and inclusion/exclusion criteria</th><th>Study population</th><th>Results</th></tr>
<tr>
<td>Jagers op Akkerhuis (2002)

Department of Surgery, Atrium Medisch Centrum, Heerlen, The Netherlands.</td>
<td>Surgical excision compared with hyaluronidase + aspiration + puncture.

Surgical excision
Procedure details:
Pneumatic tourniquet applied and tissue surrounding ganglion infiltrated with lidocaine 1%. Ganglion together with its connection to the wrist capsule is surgically excised. Pressure bandage worn for 48 hours postoperatively.

Hyaluronidase + aspiration
Procedure details:
Ganglion injected with hyaluronidase (150 units) in 1 ml saline, aspirated 1 minute later and punctures with a fine needle. If ganglion still present 3 weeks later, procedure is repeated once.</td>
<td>Level of evidence (NHMRC): II intervention

Method of randomisation:
Not stated

Allocation concealment:
Sealed envelope method

Details of blinding:
Not stated

Duration of follow-up:
6 months

Losses to follow-up:
9/100 withdrew from study.
2 surgical excision patients excluded due to the fact that no ganglion was found at exploration.

Study period: Not stated

Procedural team details: Both procedures (excision and aspiration) were done by one surgeon

Inclusion criteria:
Untreated ganglia of wrist or foot

Exclusion criteria:
Not stated

Patients excluded [n/N]: Not stated</td>
<td>Sample size:
Surgical excision: 50
Hyaluronidase + aspiration: 50

Age (median years) [SD]:
Surgical excision: 38 [17.1]
Hyaluronidase + aspiration: 41 [15.6]

Sex mix (M/F):
Surgical excision: 16/27
Hyaluronidase + aspiration: 11/35

Site of ganglia:

<table>
<tr><th>Location</th><th>Excision</th><th>Aspiration</th></tr>
<tr><td>Dorsal</td><td>25</td><td>28</td></tr>
<tr><td>Volar</td><td>13</td><td>10</td></tr>
<tr><td>Foot</td><td>8</td><td>5</td></tr>
</table>

Initial symptoms:

<table>
<tr><th></th><th>Hyaluronidase + aspiration (n=43)</th><th>Surgical excision (n=46)</th></tr>
<tr><td>Pain</td><td></td><td></td></tr>
<tr><td>None</td><td>7 (16.3%)</td><td>4 (8.7%)</td></tr>
<tr><td>Sometimes</td><td>25 (58.1%)</td><td>19 (41.3%)</td></tr>
<tr><td>Continuous</td><td>9 (20.9%)</td><td>14 (30.4%)</td></tr>
<tr><td>Unknown</td><td>2 (4.7%)</td><td>9 (19.6%)</td></tr>
<tr><td>Loss of strength</td><td>11 (25.6%)</td><td>14 (30.4%)</td></tr>
</table>
</td>
<td>Effectiveness:
Recurrence rate
Surgical excision: 11/46 (24%)
Hyaluronidase + aspiration: 37/43 (86%); second treatment: 17/20 (85%). Overall: 33/43 (77%).

Recurrence rates were significantly different between treatment groups P-value: P<0.0001

Safety:
Not reported</td>
</tr>
</table>

Table B2 *continued*: Evidence table of included randomised controlled trials investigating treatment of wrist ganglia

<table>
<tr><th>Study details</th><th>Aim and intervention</th><th>Study design and inclusion/exclusion criteria</th><th>Study population</th><th>Results</th></tr>
<tr>
<td>Limpaphayom and Wilairatana (2004)

Department of Orthopaedics, King Chulalongkorn Memorial Hospital, Thai Red Cross Society. Department of Orthopaedic, Faculty of Medicine, Chulalongkorn University.</td>
<td>Surgical excision compared with aspiration with methylprednisolone acetate injection plus wrist immobilisation

Surgical excision
Procedure details:
Surgical excision conducted under direct vision. 5cc of 1% Xylocaine was infiltrated over the mass and esmach bandage used to control bleeding. Skin closed with nylon and compressive dressing.

Aspiration
Procedure details:
Aspiration with an 18–gauge needle, each ganglion aspirated by a single attempt and 40-mg/mL methylprednisolone acerate (1 mL) injected with same needle. Gauze compressive dressing applied to aspirated area and wrist was immobilised by short arm volar slab in slight dorsiflexion position for 2 weeks.</td>
<td>Level of evidence (NHMRC): II intervention

Method of randomisation:
Not stated

Allocation concealment:
Sealed envelope method

Details of blinding:
Not stated

Duration of follow-up:
6 months

Losses to follow-up:
4/28 patients lost to follow-up.

Study period: 2000–2002

Procedural team details: Not stated

Inclusion criteria:
1) Age >15 years
2) First time dorsal carpal ganglion
3) No known history of steroid usage or allergy to steroid

Exclusion criteria:
1) Recurrence of dorsal carpal ganglion
2) Known history of steroid usage or allergy
3) Known history of wrist injury

Patients excluded [n/N]: Not stated

Power calculation: The sample size was calculated by the sample size for the negative trial method. The success rate of surgical excision was set to 95%, and 30% difference in success was determined clinically acceptable (α=0.05, β=0.10). The calculated sample size was 11 in each group when adding 10% drop-out.</td>
<td>Sample size:
Surgical excision: 14
Aspiration: 14

Age (median years) [SD]:
Surgical excision: 29.91 [9.79]
Aspiration: 32.00 [13.08]

Sex mix (M/F):
Surgical excision: 2/9
Aspiration: 2/11

Site of ganglia:
Dorsal carpal

Initial symptoms:

<table>
<tr><th></th><th>Surgery (n=11)</th><th>Aspiration (n=13)</th><th>P-value</th></tr>
<tr><td>Pain</td><td>63.6%</td><td>53.8%</td><td>0.637</td></tr>
<tr><td>Weakness</td><td>9.1%</td><td>7.7%</td><td></td></tr>
<tr><td>Malignancy concern</td><td>–</td><td>7.7%</td><td></td></tr>
<tr><td>Cosmetic</td><td>–</td><td>7.7%</td><td></td></tr>
<tr><td>Anxious</td><td>27.3%</td><td>23.1%</td><td>0.764</td></tr>
<tr><td>Location (left)</td><td>45.4%</td><td>46.2%</td><td></td></tr>
<tr><td>Location (right)</td><td>54.5%</td><td>53.8%</td><td>0.647</td></tr>
<tr><td>Size</td><td></td><td></td><td></td></tr>
<tr><td>0–1cm</td><td>36.4%</td><td>38.5%</td><td></td></tr>
<tr><td>1–3cm</td><td>68.6%</td><td>53.8%</td><td></td></tr>
<tr><td>>3cm</td><td>–</td><td>7.7%</td><td>0.622</td></tr>
</table>
</td>
<td>Effectiveness:
<table>
<tr><th></th><th>Success</th><th>Recurrence</th><th>Total</th></tr>
<tr><td>Surgery</td><td>9 (81.8%)</td><td>2 (18.2%)</td><td>11 (100%)</td></tr>
<tr><td>Aspiration</td><td>5 (38.5%)</td><td>8 (61.5%)</td><td>13(100%)</td></tr>
<tr><td>Total</td><td>14</td><td>10</td><td>24</td></tr>
</table>
Significant difference between success rate for surgical excision compared with aspiration (P=0.047).

Safety:
No complications observed following treatment during the study period.</td>
</tr>
</table>

Table B3: Evidence table of included pseudorandomised controlled trials investigating treatment of wrist ganglia

<table>
<tr><th>Study details</th><th>Aim and intervention</th><th>Study design and inclusion/exclusion criteria</th><th>Study population</th><th>Results</th></tr>
<tr>
<td>Paul and Sochart (1997)

Department of Orthopaedic Surgery, Manchester Royal Infirmary, Manchester, UK</td>
<td>Aspiration under local anaesthetic with instillation of steroid alone or with prior injection with hyaluronidase.

Aspiration + steroid injection
Procedure details: Local anaesthetic infiltration (0.5% lignocaine) adjacent to ganglion. 0.5 mL of ganglion contents aspirated via 16-gauge needles to confirm diagnosis and location. Inject hyaluronidase (leave 20 minutes) followed by aspiration and instillation of methylprednisolone (40 mL)

Comparator
Procedure details: Aspiration and instillation of methylprednisolone (40 mL)</td>
<td>Level of evidence (NHMRC): III-I intervention

Method of pseudorandomisation: Patients allocated on first attendance, alternate basis, no selection criteria other than the presence of a hand/wrist ganglion

Allocation concealment: Not stated

Details of blinding: Not performed

Duration of follow-up: At least 2 years

Losses to follow-up: None

Study period: Not stated

Procedural team details: All procedures performed by one surgeon

Inclusion criteria: Presence of a hand/wrist ganglia

Exclusion criteria: Not stated</td>
<td>Sample size:
Hyaluronidase, aspiration and steroid instillation: 35 (13 male, 22 female)
Aspiration and steroid instillation: 35 (16 male, 19 female)

Age (average years):
Hyaluronidase, aspiration and steroid instillation: 39.1
Aspiration and steroid instillation: 41.4

Previous ganglion treatment:
None

Patient details:
<table>
<tr><th></th><th>Male</th><th>Female</th><th>Age (years)</th><th>Dominant hand</th><th>Nondominant hand</th></tr>
<tr><td>Hyaluronidase, aspirate and steroid</td><td>13</td><td>22</td><td>39.1</td><td>25</td><td>10</td></tr>
<tr><td>Aspirate and steroid</td><td>16</td><td>19</td><td>41.4</td><td>17</td><td>18</td></tr>
</table>
Site of ganglia:
<table>
<tr><th>Site</th><th>Hyaluronidase, aspirate and steroid</th><th>Aspirate and steroid</th></tr>
<tr><td>Wrist (extensor)</td><td>18</td><td>21</td></tr>
<tr><td>Wrist (flexor)</td><td>14</td><td>13</td></tr>
<tr><td>Finger</td><td>2</td><td>–</td></tr>
<tr><td>Thumb</td><td>1</td><td>–</td></tr>
<tr><td>Anatomical snuff box</td><td>–</td><td>1</td></tr>
</table>
Initial symptoms: 72% had persistent localised swelling and 25% had pain. Separate group symptoms not provided.</td>
<td>Effectiveness:
<table>
<tr><th>Grade</th><th>Hyaluronidase, aspirate and steroid</th><th>Aspirate and steroid</th><th>P value</th></tr>
<tr><td>Excellent</td><td>17 (49%)</td><td>7 (20%)</td><td>0.0051</td></tr>
<tr><td>Good</td><td>14 (40%)</td><td>13 (37%)</td><td>ns</td></tr>
<tr><td>Poor</td><td>4 (11%)</td><td>15 (43%)</td><td>ns</td></tr>
<tr><td>Good + Excellent</td><td>31 (89%)</td><td>20 (57%)</td><td>0.0072</td></tr>
</table>
Excellent — no residual palpable lump
Good — lump present but significantly smaller
Poor — recurrence of ganglion

Safety:
Hyaluronidase, aspiration and steroid injection:
One superficial infection
Two mild localised rash
One case of depigmentation

Aspiration and steroid injection:
One superficial infection</td>
</tr>
</table>

Table B3 *continued*: Evidence table of included pseudorandomised controlled trials investigating treatment of wrist ganglia

<table>
<tr><th>Study details</th><th>Aim and intervention</th><th>Study design and inclusion/ exclusion criteria</th><th>Study population</th><th>Results</th></tr>
<tr>
<td>Stephen et al (1999)

Department of Orthopaedic and Accident Surgery, University Hospital, Queen's Medical Centre, Nottingham</td>
<td>Multiple puncture + aspiration versus aspiration alone

Aspiration alone
Procedure details:
Aspiration with a 19-gauge needle and a 5-mL syringe

Multiple puncture and aspiration
Procedure details:
Aspiration (as above) followed by multiple punctures (4 times with needle tip)</td>
<td>Level of evidence (NHMRC): III-I intervention

Method of pseudorandomisation:
Patients referred to hand clinic over 1 year randomised into groups according to hospital number. Odd numbers received multiple puncture + aspiration, even numbers received aspiration only

Allocation concealment:
Not stated

Details of blinding:
Blinding not possible

Duration of follow-up: 1-year questionnaire

Losses to follow-up:
Aspiration alone: 14/65
Multiple puncture + aspiration: 13/54

Study period: Not stated

Procedural team details:
Not stated

Inclusion criteria:
Adult patients with wrist ganglia

Exclusion criteria:
Not stated</td>
<td>Sample size:
Aspiration alone: 65 ganglia
Multiple puncture + aspiration: 54 ganglia

Age:
Not stated

Sex mix (M/F):
1 male: 3.1 female

Previous ganglion treatment:
None

Site of ganglia:

<table>
<tr><th>Site</th><th>Percentage</th></tr>
<tr><td>Dorso- radial</td><td>37%</td></tr>
<tr><td>Dorsal midline</td><td>32%</td></tr>
<tr><td>Palmar radial</td><td>16%</td></tr>
<tr><td>Ulna border</td><td>7%</td></tr>
</table>
Note: Estimated based on graph presented in study
Separate values for each group not provided.

Initial symptoms: Not stated</td>
<td>Effectiveness:
Recurrence rate:
Aspiration alone: 69%
Multiple puncture + aspiration: 78%
(Differences was not statistically significant)

No correlation between anatomical site of ganglion, sex and working status with success rate.

Safety:
Not reported</td>
</tr>
</table>

Table B3 *continued*: Evidence table of included pseudorandomised controlled trials investigating treatment of wrist ganglia

Study details	Aim and intervention	Study design and inclusion/exclusion criteria	Study population	Results
Varley et al (1997) Queen's Medical Centre, Nottingham and Glan Clwyd Hospital, Bodelwyddan, UK	Aspiration versus aspiration with steroid injection Aspiration *Procedure details:* Ganglia aspirated with 19-gauge hypodermic needle and 2-mL syringe. Aspiration facilitated by milking ganglion contents towards needle with finger. Aspiration + steroid injection *Procedure details:* Similar to aspiration only group but with the added step of methylprednisolone injection (1 mL 40 mg/mL) after the procedure.	Level of evidence (NHMRC): III-1 intervention Method of pseudorandomisation: Randomised according to hospital number Allocation concealment: Not stated Details of blinding: Not stated Duration of follow-up: Invited to clinic at 2 and 4 months after treatment. Questionnaires sent at 6 months and within 2 years of treatment Losses to follow-up: 28/113 (25%) patients lost to follow-up Study period: 1992 Procedural team details: Not stated Inclusion criteria: Patients with wrist ganglia that has been present for >3 months. Exclusion criteria: Not stated	Sample size: Aspiration: 42 Aspiration + steroid: 43 Age (median years) [range]: Aspiration: 38 [13–71] Aspiration + steroid: 35 [15–75] Sex mix (M/F): Aspiration: 10/32 Aspiration + steroid: 12/31 Site of ganglia: *Aspiration:* Palmar: 13 Dorsal: 29 *Aspiration + steroid:* Palmar: 8 Dorsal: 35 Initial symptoms: 70% of patients rated their ganglia as constantly or intermittently painful	Effectiveness: *Treatment results:* Aspiration: 33% resolved Aspiration + steroid: 33% resolved. 22/57 (38.6%) patients who had recurrence opted for surgical excision. Safety: Not reported