

## Review Article

# Treatment of Ganglion Cysts

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Ganglion cysts are soft tissue swellings occurring most commonly in the hand or wrist. Apart from swelling, most cysts are asymptomatic. Other symptoms include pain, weakness, or paraesthesia. The two main concerns patients have are the cosmetic appearance of the cysts and the fear of future malignant growth. It has been shown that 58% of cysts will resolve spontaneously over time. Treatment can be either conservative or through surgical excision. This review concluded that nonsurgical treatment is largely ineffective in treating ganglion cysts. However, it advised to patients who do not surgical treatment but would like symptomatic relief. Compared to surgery, which has a lower recurrence rate but have a higher complication rate with longer recovery period. It has been shown that surgical interventions do not provide better symptomatic relief compared to conservative treatment. If symptomatic relief is the patient's primary concern, a conservative approach is preferred, whilst surgical intervention will decrease the likelihood of recurrence.

## 1. Introduction

Ganglion cyst is the most common soft tissue swelling in hand and wrist. It occurs most commonly on the dorsal side of the wrist (70%), followed by volar side (20%) of wrist and tendon sheath of fingers. Most of the ganglion cysts are asymptomatic besides swelling. Most patients sought advice and treatment because of the cosmetic appearance or they were concerned that their ganglion was a malignant growth [1]. Treatment options include reassurance, nonsurgical means like aspiration with or without steroid injections or hyaluronidase and surgical excision. We review the treatment outcome of ganglion in the literature and compare their recurrence and complication rates.

## 2. Methods

Electronic databases of Medline, PubMed, and the Cochrane libraries were searched with the key words "ganglion," "conservative treatment," "surgery" and "outcomes." The inclusion criteria were (1) publication in English and (2) articles concerning the treatment of ganglion of hand and wrist. Recurrence rate, complications, and functional outcome were

reviewed. References in review articles were screened for potentially relevant studies not yet identified.

## 3. Reassurance

Majority of patients with ganglion do not have symptoms besides swelling, while others may present with pain, weakness, or paresthesia. Barnes et al. reported in their review that only 19.5% had symptoms other than a mass [2]. Westbrook et al. also reported majority of patients sought advice and treatment because of the cosmetic appearance or they were concerned that their ganglion was a malignant growth, while only 26% consulted because of pain and 8% consulted altered sensation or restricted hand function [1].

Many may not opt for any treatment if they are reassured of the benign nature of the disease. Also, even for painful ganglions, they cause less pain compared to other common orthopaedic problems, like carpal tunnel syndrome and osteoarthritis, in terms of Mean Visual Analogue Pain Scores [3].

The spontaneous resolution rate of untreated ganglion ranged 40–58% (Table 1) [4–7]. Therefore reassurance can be the option if the patients do not want any intervention.

TABLE 1

	FU	Resolution rate
Carp and Stout 1928	3 years	7/12 (58%)
McEvedy 1962 [4]	10 years	10/21 (48%)
Zachariae and Vibe-Hansen 1973 [5]	6 years	40/101 (40%)
Dias and Buch 2003 [6]	63 months	20/38 (53%)
Dias et al. 2007 [7]	70 months	23/55 (42%)

## 4. Conservative Treatment

**4.1. Aspiration.** Aspiration alone is one of the simplest ways to treat ganglion. However, it has high recurrence rates. Most of the studies showed more than half of ganglion treated with aspiration alone will recur (Table 2) [6–25]. Many methods have been tried in order to increase the efficacy. Zubowicz and Ishii reported a recurrence rate of 15% by repeated aspiration up to three times. However, they also noticed the successful rate decreased with those who needed repeated aspiration [10]. Multiple puncture of ganglion wall has not shown to improve the result of simple ganglion aspiration [12].

**4.2. Steroid.** Becker suggested the use of steroid injection in treating ganglion, with 87% resolution rate, based on the initial theory that chronic inflammatory may take part in the pathogenesis of ganglion. Subsequent studies showed variable successful rate. Varley et al. conducted a randomized controlled trial to aspiration with or without steroid and concluded that additional injection of steroid is of no benefit and subcutaneous fat atrophy and skin depigmentation can be the potential complications [11].

**4.3. Sclerotherapy.** Sclerotherapy has been proposed to treat ganglion. Sclerosant was injected into ganglion sac to damage the intimal lining and cause fibrosis to reduce the recurrence rate. Initial study showed high successful rate ranging 78–100%. Mackie et al., however, confirmed ganglion had no intimal lining by histological studies and reported a failure rate as high as 94%. Since there is communication between ganglion and synovial joint, sclerosant might pass from ganglion to the joint and tendon and cause damage to them [16]. Since the publication of these reports, the use of sclerotherapy had declined. New technique had been developed with the aim of causing ganglion sclerosis without the risk of damage to the joints. Gümüş used electrocautery to cause ganglion sclerosis and showed favorite results. This technique had not been widely adopted [18].

**4.4. Hyaluronidase.** The content of ganglion may be too vigorous to be drawn, and thus aspiration may not be complete. Some advocated the use of hyaluronidase, which depolymerizes the hyaluronic acid present in ganglion content. Otu reported a 95% cure rate after a follow-up period of 6 months [19]. Paul and Sochart also showed that the use of hyaluronidase in conjunction with steroid has resulted in significantly higher resolution rate compared to the use of steroid alone, but only 49% of their patients treated by

hyaluronidase and steroid had complete resolution, compared to 20% in those treated with steroid [15]. Akkerhuis et al., however, reported a recurrence rate of 77%, for treatment of ganglion with hyaluronidase [20]. Thus, the successful rate had been variable, and hyaluronidase may cause allergic reaction.

**4.5. Immobilization.** Immobilization following aspiration had showed conflicting results. Richman et al. showed that 3-week immobilization after aspiration and multiple puncture had a significantly higher successful rate for dorsal carpal ganglion, but the result for palmar ganglion was inconclusive [21]. On the other hand, Korman et al. concluded that immobilization did not significantly improve the successful treatment of ganglions over perforation and aspiration alone and had the potential adverse effects of inconvenience, economic repercussions, and stiffness [22].

**4.6. Threat Technique.** Gang and Makhlof introduce the thread technique, by which two sutures were passed through the ganglion at right angles to each other, and each was tied in a loop. The contents of ganglion were expelled by massage at interval. They reported a recurrence rate of 4.8%. However, 11% of the patients had positive culture swabs [24]. Singhal et al. described a similar technique, but the complete resolution rate was only 50% [25].

Taking into account that nearly half of the ganglion would resolve spontaneously, with such a high failure rate, nonsurgical treatment of ganglion was generally ineffective. However, the complications were considered less (Table 3) [6–25]. Some reported zero percent of complication rates, while others reported minor complications like transient pain and swelling. Therefore, nonsurgical treatment can be considered to be an alternative way for symptomatic relief if the patients do not want surgery.

Another advantage of conservative treatment is that aspiration of ganglion contents confirms a benign diagnosis and allays the patients' fear and desire for further treatment.

## 5. Surgery

In 1976, Angelides and Wallace [26] introduced the techniques of excising the whole ganglion including the cyst, its attachments to the scapholunate ligament, and the involved segment of joint capsule, to reduce the recurrence rate. It is now considered to be the most effective technique.

**5.1. Recurrence.** According to the study conducted by Angelides and Wallace, the recurrence rate can be as low as 1%. However, subsequent recurrence rate of surgical excision reported by the literatures was variable (Table 4) [6, 7, 13, 20, 23, 26–29, 31–47], with the range of 0–31.2%. There were only two randomized controlled trials comparing the recurrence rate of conservative treatment to surgery. Limpaphayom and Wilairatana compared aspiration, steroid injection, and immobilization with surgery, while Akkerhuis et al. compared hyaluronidase with surgery. Both of them reported surgery had a lower recurrence rate [20, 23].

TABLE 2

	FU	Failure rate*	
Aspiration			
Nield and Evans 1986 [8]	1 year	20/34 (59%)	
Esteban et al. 1986 [9]	27 months (3–71)	6/17 (35%)	
Zubowicz and Ishii 1987 [10]	1 year–20 months	7/47 (15%)	
Varley et al. 1997 [11]	48 months (26–89)	28/42 (67%)	
Stephen et al. 1999 [12]	1 year	35/51 (69%)	
Aspiration with or without steroid			
Dias and Buch 2003 [6]	5 years	18/38 (47%)	
Dias et al. 2007 [7]	70 months	45/78 (58%)	
Steroid			
Wright et al. 1994 [13]	5 years (2–11 years)	20/24 (83%)	
Breidahl and Adler 1996 [14]	12 months	6/10 (60%)	
Paul and Sochart 1997 [15]	2 years	28/35 (80%)	
Varley et al. 1997 [11]	46 months (26–89)	29/43 (67%)	
Sclerotherapy			
Mackie et al. 1984 [16]	3 months	15/16 (94%)	Sclerosant (sodium tetradecyl disulphate)
Dogo et al. 2003 [17]	24–36 months	1/29 (3.4%)	Sclerosant (hypertonic saline)
Gümüş 2009 [18]	17 months (6–29)	1/17 (5.9%)	Transcutaneous electrocauterization
Hyaluronidase			
Otu 1992 [19]	6 months	17/349 (5%)	
Paul and Sochart 1997 [15]	2 years	18/35 (51%)	
Akkerhuis et al. 2002 [20]	1 year	33/43 (77%)	
Aspiration + multiple puncture			
Richman et al. 1987 [21]	22 months	32/45 (71%)	
Korman et al. 1992 [22]	1 year	18/36 (50%)	
Stephen et al. 1999 [12]	1 year	32/41 (78%)	
Aspiration + multiple puncture + immobilization			
Richman et al. 1987 [21]	22 months	24/42 (57%)	
Korman et al. 1992 [22]	1 year	16/33 (48%)	
Aspiration + steroid + immobilization			
Limpaphayom and Wilairatana 2004 [23]	6 months	8/13 (62%)	
Thread technique			
Gang and Makhloof 1988 [24]	Min. 6 months	3/62 (4.8%)	
Singhal et al. 2005 [25]	2 years	13/26 (50%)	

\* Failure rate = recurrence + in complete resolution.

**5.2. Complications.** Complications for surgical excision included wound infection, neuroma formation, hypertrophic scar, median nerve, and radial artery damage, with complication rate ranging 0–56% (Table 5) [6, 7, 13, 20, 23, 26–29, 31–47]. In Dias and Buch's cohort study, surgery (20%) had a higher complication rate compared with aspiration (5%) or reassurance [6].

Scapholunate instability has been reported after dorsal wrist ganglion excision. Some suggested periscaphoid ligamentous injury was a cause of ganglion rather than a complication of surgery [30, 49]. Kivett et al. examined 61 postganglionectomy patients by physical examination and radiography and concluded that ganglion excision did not destabilise the wrist [50].

**5.3. Mobility and Other Outcomes.** Surgery may not result in favourable outcomes. Angelides et al. reported 1.2% of patients had 0–10 degree loss of volar flexion after surgery, although this had no functional significant [26]. Sanders studied nine patients with occult dorsal ganglion. One out of eight who attended followup had residual pain after surgery, while three out of eight had limited motion [48]. Clay and Clement reported that while surgery resulted in improvement of pain in 79%, it worsen the pain in 8% of patients. 17% of patients complained of weakened grip with 2% demonstrating loss of grip strength of more than 20% compared with opposite hand [28]. Residual pain, limited range of motion, and weaken grip were also reported in other studies (Table 6).

TABLE 3

	Method	Complication rate	Complications
Esteban et al. 1986 [9]	Aspiration	0	
Dias and Buch 2003 [6]	Aspiration/steroid	5%	Scar tender
Dias et al. 2007 [7]	Aspiration/steroid	2/78 (2.56%)	
Paul and Sochart 1997 [15]	Steroid	4/35 (11%)	Superficial infection, mild localized rash, and small area of depigmentation
Dogo et al. 2003 [17]	Hypertonic saline	0	50% swelling, 6/29 severe pain
Gümüş 2009 [18]	Transcutaneous electrocauterization	0	8 cases of transient swelling and pain
Paul and Sochart 1997 [15]	Hyaluronidase	1/35 (2.9%)	Superficial infection
Richman et al. 1987 [21]	Multiple puncture	0	
Richman et al. 1987 [21]	Immobilization	0	
Limpaphayom and Wilairatana 2004 [23]	Immobilization	0	
Gang and Makhoulouf 1988 [24]	Thread technique	7/62 (11%)	Positive culture swab
Singhal et al. 2005 [25]	Thread technique	3/26 (12%)	Localized rash, mild restriction

TABLE 4

		FU	Recurrence rate
Open excision			
Angelides and Wallace 1976 [26]	Dorsal	9 months–25 years	3/346 (0.87%)
Janzon and Niechajev 1981 [27]		5 years	21/144 (15%)
Clay and Clement 1988 [28]	Dorsal	28 months (12–74 months)	2/51 (3.9%)
Watson et al. 1989 [29, 30]	Dorsal and palmar	16 years	0/10 (0%)
Jacobs and Govaers 1990 [31]	Palmar	70 months (3–220)	20/71 (28%)
Wright et al. 1994 [13]	Palmar	5 years (2–11 years)	14/72 (19%)
Filan and Herbert 1996 [32]	Recurrent dorsal	14 months (12–22)	0/7 (0%)
Hwang et al. 1999 [33]	Dorsal		1/19 (5.3%)
Faithfull and Seeto 2000 [34]	Dorsal and palmar	65 months (6–133)	6/59 (10%)
Gündeş et al. 2000 [35]	24 dorsal	27 months (6–48)	8.3%
	16 volar		31.2%
Akkerhuis et al. 2002 [20]	Wrist and foot	12 months	11/46 (24%)
Limpaphayom and Wilairatana 2004 [23]	Dorsal	6 months	2/11 (18%)
Kang et al. 2008 [36]	Dorsal	12 months	2/23 (8.7%)
Rocchi et al. 2008 [37]	Palmar	24 months	1/25 (4%)
Arthroscopy + open			
Dias and Buch 2003 [6]	Palmar	5 years	33/79 (42%)
Dias et al. 2007 [7]	Dorsal	70 months	40/103 (39%)
Arthroscopic resection			
Osterman and Raphael 1995 [38]	Dorsal		0/18 (0%)
Luchetti et al. 2000 [39]	Dorsal	16 months	2/34 (5.9%)
Ho et al. 2001 [40]	Dorsal	25 months (6–44)	5/19 (26%)
	Palmar	16.4 months (10–25)	0/5 (0%)
Nishikawa et al. 2001 [41]	Dorsal	20 months	2/37 (5.4%)
Shih et al. 2002 [42]	Dorsal	26.8 months (15–37)	0/32 (0%)
Rizzo et al. 2004 [43]	Dorsal	47.8 months (28–97)	2/41 (4.9%)
Mathoulin et al. 2004 [44]	Dorsal	34 months (12–46)	4/96 (4.2%)
	Palmar	26 months (12–39)	0/32 (0%)
Rocchi et al. 2006 [45]	Dorsal and palmar	15 months (3–26)	2/47 (4.3%)
Kang et al. 2008 [36]	Dorsal	12 months	2/28 (7.1%)
Rocchi et al. 2008 [37]	Palmar	24 months	3/25 (12%)
Edwards and Johansen 2009 [46]	Dorsal	Min. 24 months	0/55 (0%)
Chen et al. 2010 [47]	Dorsal and palmar	15.3 months	1/15 (6.7%)

TABLE 5

Complication rate			
Open excision			
Angelides and Wallace 1976 [26]	Dorsal	0/346 (0%)	1.2% had 0–10 degree loss of volar flexion
Janzon and Niechajev 1981 [27]		Not reported	
Clay and Clement 1988 [28]	Dorsal	0/51 (0%)	1 had evidence of scapholunate dissociation
Watson et al. 1989 [29, 30]	Dorsal and palmar	Not reported	
Jacobs and Govaers 1990 [31]	Palmar	20/71 (28%)	20 had unsatisfactory scar (2 had evidence of neuroma), 20 had evidence of median nerve damage
Wright et al. 1994 [13]	Palmar	6/72 (8.3)	superficial infection, tendinitis, and pain dystrophy
Filan and Herbert 1996 [32]	Recurrent dorsal	Not reported	
Hwang et al. 1999 [33]	Dorsal	3/19 (16%)	1 suture abscess, 1 loss of wrist flexion of 45 degree, and 1 transient neuropraxia
Faithfull and Seeto 2000 [34]	Dorsal and palmar	Not reported	
Gündeş et al. 2000 [35]	24 dorsal	12.5%	1 had evidence of radial nerve injuries
	16 volar	56%	2 had evidence of median nerve injuries, 2 had radial artery injuries
Akkerhuis et al. 2002 [20]	Wrist and foot	Not reported	
Limpaphayom and Wilairatana 2004 [23]	Dorsal	0/11 (0%)	
Kang et al. 2008 [36]	Dorsal	0/23 (0%)	
Rocchi et al. 2008 [37]	Palmar	7/25 (28%)	4 radial artery injuries, 2 partial stiffness of the wrist, and 1 neuropraxia
Arthroscopy + open			
Dias and Buch 2003 [6]	Palmar	20%	
Dias et al. 2007 [7]	Dorsal	8/103 (7.8%)	3 numbness, 4 scar tender, and 1 keloid
Arthroscopic resection			
Osterman and Raphael 1995 [38]	Dorsal	0/18 (0%)	
Luchetti et al. 2000 [39]	Dorsal	0/34 (0%)	
Ho et al. 2001 [40]	Dorsal	0/19 (0%)	
	Palmar	0/5 (0%)	
Nishikawa et al. 2001 [41]	Dorsal	0/37 (0%)	
Shih et al. 2002 [42]	Dorsal	Not reported	
Rizzo et al. 2004 [43]	Dorsal	10/47 (21%)	10 postoperative stiffness
Mathoulin et al. 2004 [44]	Dorsal	0/96 (0%)	
	Palmar	1/32 (3.1%)	1 hematoma
Rocchi et al. 2006 [45]	Dorsal and palmar	4/47 (8.5%)	1 radial artery injury, 1 haematoma, and 2 axonotmesis
Kang et al. 2008 [36]	Dorsal	1/41 (2.1%)	1 neuropraxia
Rocchi et al. 2008 [37]	Palmar	2/25 (8%)	1 neuropraxia, 1 injury to a branch of the radial artery
Edwards and Johansen 2009 [46]	Dorsal	3/55 (5.5%)	3 extensor tenosynovitis
Chen et al. 2010 [47]	Dorsal and palmar	1/15 (6.7%)	1 case of transient paresthesia

TABLE 6

	Residual pain	Limited ROM	Reduced grip power	Loss of function
Sanders 1985 [48]	13%	38%	0	0
Clay and Clement 1988 [28]	Improved in 79%, worsen in 8%	17%	0	0
Wright et al. 1994 [13]	8.3%	2.8%	17%	0
Faithfull and Seeto 2000 [34]	14%	0	0	10%
Dias and Buch 2003 [6]	16%	10%	23%	0
Dias et al. 2007 [7]	27%	15%	34%	0

TABLE 7

	Mean recovery time	Time off work
Open		
Janzon and Niechajev 1981 [27]		Majority 10–20 days
Jacobs and Govaers 1990 [31]		Majority 7–18 days (median 2.5 weeks)
Rocchi et al. 2008 [37]	15 days	23 days
Open + arthroscopy		
Dias and Buch 2003 [6]		14.1 days
Dias et al. 2007 [7]		10.9 days
Arthroscopy		
Luchetti et al. 2000 [39]		15 days
Nishikawa et al. 2001 [41]	16 days (7–56)	
Rocchi et al. 2008 [37]	6 days	10 days

Dias conducted two prospective cohort comparing the outcomes of dorsal and palmar ganglions, respectively, treated by surgery with those treated by reassurance and aspiration. No significant difference was found in persistent symptoms and symptom relief among three groups. However, those treated with surgery had significantly higher recovery times, with averaged 14.1 days and 10.9 days off work for palmar and dorsal wrist ganglion excision, respectively, compared to averaged 3.5 days and 3.2 days for aspiration of palmar and dorsal wrist ganglion [5, 6] (Table 7).

**5.4. Arthroscopic Excision.** In 1995, Osterman and Raphael described a technique of arthroscopic excision of dorsal wrist ganglia. Arthroscopic resection has the potential advantages of minimizing the surgical scar and permits evaluation of any intra-articular pathologic condition of either midcarpal or radiocarpal joints [38].

Majority of initial reports on recurrence rate look more favourable than open excision (Tables 4 and 5). However, a prospective, randomized study in 2008 showed rates of recurrence with arthroscopic dorsal ganglion excision (3/28) are comparable with and not superior to those of open excision (2/23). Additional long-term comparative studies are needed to accurately differentiate the efficacy of open and arthroscopic techniques [36].

## 6. Conclusion

Majority of patients with ganglion do not have symptoms. Given that the spontaneous resolution rate of ganglion can be as high as 58%. Reassurance and observation can be the option if the patients are asymptomatic or do not want any intervention. Nonsurgical treatments of ganglion including aspiration, steroid injection sclerotherapy, and hyaluronidase were generally ineffective. However, since they had lower complication rates, they can be used for symptomatic relief if the patients do not want surgery. Surgery had a lower

recurrence rate than conservative treatment. However it has higher rates of complication and longer recovery period, and the rate of symptomatic relief may not be higher than other treatments.

## References

- [1] A. P. Westbrook, A. B. Stephen, J. Oni, and T. R. C. Davis, "Ganglia: the patient's perception," *Journal of Hand Surgery*, vol. 25, no. 6, pp. 566–567, 2000.
- [2] W. E. Barnes, R. D. Larsen, and J. L. Posch, "Review of ganglia of the hand and wrist with analysis of surgical treatment," *Plastic and Reconstructive Surgery*, vol. 34, pp. 570–578, 1964.
- [3] P. J. Tomlinson and J. Field, "Morbidity of hand and wrist ganglia," *Hand Surgery*, vol. 11, no. 1-2, pp. 5–8, 2006.
- [4] B. V. McEvedy, "Simple ganglia," *The British Journal of Surgery*, vol. 49, no. 218, pp. 585–594, 1962.
- [5] L. Zachariae and H. Vibe-Hansen, "Ganglia. Recurrence rate elucidated by a follow up of 347 operated cases," *Acta Chirurgica Scandinavica*, vol. 139, no. 7, pp. 625–628, 1973.
- [6] J. J. Dias and K. Buch, "Palmar wrist ganglion: does intervention improve outcome: a prospective study of the natural history and patient-reported treatment outcomes," *Journal of Hand Surgery*, vol. 28, no. 2, pp. 172–176, 2003.
- [7] J. J. Dias, V. Dhukaram, and P. Kumar, "The natural history of untreated dorsal wrist ganglia and patient reported outcome 6 years after intervention," *Journal of Hand Surgery: European Volume*, vol. 32, no. 5, pp. 502–508, 2007.
- [8] D. V. Nield and D. M. Evans, "Aspiration of ganglia," *Journal of Hand Surgery*, vol. 11, no. 2, p. 264, 1986.
- [9] J. M. Esteban, Y. C. Oertel, M. Mendoza, and S. M. Knoll, "Fine needle aspiration in the treatment of ganglion cysts," *Southern Medical Journal*, vol. 79, no. 6, pp. 691–693, 1986.
- [10] V. N. Zubowicz and C. H. Ishii, "Management of ganglion cysts of the hand by simple aspiration," *Journal of Hand Surgery*, vol. 12, no. 4, pp. 618–620, 1987.
- [11] G. W. Varley, M. Needoff, T. R. C. Davis, and N. R. Clay, "Conservative management of wrist ganglia: aspiration versus steroid infiltration," *Journal of Hand Surgery: European Volume*, vol. 22, no. 5, pp. 636–637, 1997.
- [12] A. B. Stephen, A. R. Lyons, and T. R. C. Davis, "A prospective study of two conservative treatments for ganglia of the wrist," *Journal of Hand Surgery: European Volume*, vol. 24, no. 1, pp. 104–105, 1999.
- [13] T. W. Wright, W. P. Cooney, and D. M. Ilstrup, "Anterior wrist ganglion," *Journal of Hand Surgery*, vol. 19, no. 6, pp. 954–958, 1994.
- [14] W. H. Bredahl and R. S. Adler, "Ultrasound-guided injection of ganglia with coricosteroids," *Skeletal Radiology*, vol. 25, no. 7, pp. 635–638, 1996.
- [15] A. S. Paul and D. H. Sochart, "Improving the results of ganglion aspiration by the use of hyaluronidase," *Journal of Hand Surgery: European Volume*, vol. 22, no. 2, pp. 219–221, 1997.
- [16] I. G. Mackie, C. B. Howard, and P. Wilkins, "The dangers of sclerotherapy in the treatment of ganglia," *Journal of Hand Surgery*, vol. 9, no. 2, pp. 181–184, 1984.
- [17] D. Dogo, A. W. Hassan, and U. Babayo, "Treatment of ganglion using hypertonic saline as sclerosant," *West African Journal of Medicine*, vol. 22, no. 1, pp. 13–14, 2003.

- [18] N. Gümüş, "A new sclerotherapy technique for the wrist ganglion: transcutaneous electrocauterization," *Annals of Plastic Surgery*, vol. 63, no. 1, pp. 42–44, 2009.
- [19] A. A. Otu, "Wrist and hand ganglion treatment with hyaluronidase injection and fine needle aspiration: a tropical African perspective," *Journal of the Royal College of Surgeons of Edinburgh*, vol. 37, no. 6, pp. 405–407, 1992.
- [20] M. J. O. Akkerhuis, M. van der Heijden, and P. R. G. Brink, "Hyaluronidase versus surgical excision of ganglia: a prospective, randomized clinical trial," *Journal of Hand Surgery*, vol. 27, no. 3, pp. 256–258, 2002.
- [21] J. A. Richman, R. H. Gelberman, W. D. Engber, P. B. Salamon, and D. J. Bean, "Ganglions of the wrist and digits: results of treatment by aspiration and cyst wall puncture," *Journal of Hand Surgery*, vol. 12, no. 6, pp. 1041–1043, 1987.
- [22] J. Korman, R. Pearl, and V. R. Hentz, "Efficacy of immobilization following aspiration of carpal and digital ganglions," *Journal of Hand Surgery*, vol. 17, no. 6, pp. 1097–1099, 1992.
- [23] N. Limpaphayom and V. Wilairatana, "Randomized controlled trial between surgery and aspiration combined with methylprednisolone acetate injection plus wrist immobilization in the treatment of dorsal carpal ganglion," *Journal of the Medical Association of Thailand*, vol. 87, no. 12, pp. 1513–1517, 2004.
- [24] R. K. Gang and S. Makhlof, "Treatment of ganglia by a thread technique," *Journal of Hand Surgery*, vol. 13, no. 2, pp. 184–186, 1988.
- [25] R. Singhal, N. Angmo, S. Gupta, V. Kumar, and A. Mehtani, "Ganglion cysts of the wrist: a prospective study of a simple outpatient management," *Acta Orthopaedica Belgica*, vol. 71, no. 5, pp. 528–534, 2005.
- [26] A. C. Angelides and P. F. Wallace, "The dorsal ganglion of the wrist: Its pathogenesis gross and microscopic anatomy, and surgical treatment," *Journal of Hand Surgery*, vol. 1, no. 3, pp. 228–235, 1976.
- [27] L. Janzon and I. A. Niechajev, "Wrist ganglia. Incidence and recurrence rate after operation," *Scandinavian Journal of Plastic and Reconstructive Surgery*, vol. 15, no. 1, pp. 53–56, 1981.
- [28] N. R. Clay and D. A. Clement, "The treatment of dorsal wrist ganglia by radical excision," *Journal of Hand Surgery*, vol. 13, no. 2, pp. 187–191, 1988.
- [29] H. K. Watson, W. D. Rogers, and D. Ashmead IV, "Reevaluation of the cause of the wrist ganglion," *Journal of Hand Surgery*, vol. 14, no. 5, pp. 812–817, 1989.
- [30] H. K. Watson, W. D. Rogers, and D. Ashmead IV, "Reevaluation of the cause of the wrist ganglion," *Journal of Hand Surgery*, vol. 14, no. 5, pp. 812–817, 1989.
- [31] L. G. H. Jacobs and K. J. M. Govaers, "The volar wrist ganglion: just a simple cyst?" *Journal of Hand Surgery*, vol. 15, no. 3, pp. 342–346, 1990.
- [32] S. L. Filan and T. J. Herbert, "Recurrent dorsal wrist ganglion: aetiology and treatment," *Hand Surgery*, vol. 1, no. 1, pp. 7–9, 1996.
- [33] J. J. Hwang, C. A. Goldfarb, R. H. Gelberman, and M. I. Boyer, "The effect of dorsal carpal ganglion excision on the scaphoid shift test," *Journal of Hand Surgery: European Volume*, vol. 24, no. 1, pp. 106–108, 1999.
- [34] D. K. Faithfull and B. G. Seeto, "The simple wrist ganglion—more than a minor surgical procedure?" *Hand Surgery*, vol. 5, no. 2, pp. 139–143, 2000.
- [35] H. Gündeş, Y. Cirpici, A. Sarlak, and S. Müezzinoğlu, "Prognosis of wrist ganglion operations," *Acta Orthopaedica Belgica*, vol. 66, no. 4, pp. 363–367, 2000.
- [36] L. Kang, E. Akelman, and A. P. C. Weiss, "Arthroscopic versus open dorsal ganglion excision: a prospective, randomized comparison of rates of recurrence and of residual pain," *Journal of Hand Surgery*, vol. 33, no. 4, pp. 471–475, 2008.
- [37] L. Rocchi, A. Canal, F. Fanfani, and F. Catalano, "Articular ganglia of the volar aspect of the wrist: arthroscopic resection compared with open excision. A prospective randomised study," *Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery*, vol. 42, no. 5, pp. 253–259, 2008.
- [38] A. L. Osterman and J. Raphael, "Arthroscopic resection of dorsal ganglion of the wrist," *Hand Clinics*, vol. 11, no. 1, pp. 7–12, 1995.
- [39] R. Luchetti, A. Badia, M. Alfarano, J. Orbay, I. Indriago, and B. Mustapha, "Arthroscopic resection of dorsal wrist ganglia and treatment of recurrences," *Journal of Hand Surgery*, vol. 25, no. 1, pp. 38–40, 2000.
- [40] P. C. Ho, J. Griffiths, W. N. Lo, C. H. Yen, and L. K. Hung, "Current treatment of ganglion of the wrist," *Hand Surgery*, vol. 6, no. 1, pp. 49–58, 2001.
- [41] S. Nishikawa, S. Toh, H. Miura, K. Arai, and T. Irie, "Arthroscopic diagnosis and treatment of dorsal wrist ganglion," *Journal of Hand Surgery*, vol. 26, no. 6, pp. 547–549, 2001.
- [42] J. T. Shih, S. T. Hung, H. M. Lee, and C. M. Tan, "Dorsal ganglion of the wrist: results of treatment by arthroscopic resection," *Hand Surgery*, vol. 7, no. 1, pp. 1–5, 2002.
- [43] M. Rizzo, R. A. Berger, S. P. Steinmann, and A. T. Bishop, "Arthroscopic resection in the management of dorsal wrist ganglions: results with a minimum 2-year follow-up period," *Journal of Hand Surgery*, vol. 29, no. 1, pp. 59–62, 2004.
- [44] C. Mathoulin, A. Hoyos, and J. Pelaez, "Arthroscopic resection of wrist ganglia," *Hand Surgery*, vol. 9, no. 2, pp. 159–164, 2004.
- [45] L. Rocchi, A. Canal, J. Pelaez, F. Fanfani, and F. Catalano, "Results and complications in dorsal and volar wrist ganglia arthroscopic resection," *Hand Surgery*, vol. 11, no. 1–2, pp. 21–26, 2006.
- [46] S. G. Edwards and J. A. Johansen, "Prospective outcomes and associations of wrist ganglion cysts resected arthroscopically," *Journal of Hand Surgery*, vol. 34, no. 3, pp. 395–400, 2009.
- [47] A. C. Y. Chen, W. C. Lee, K. Y. Hsu, Y. S. Chan, L. J. Yuan, and C. H. Chang, "Arthroscopic ganglionectomy through an intrafocal cystic portal for wrist ganglia," *Arthroscopy*, vol. 26, no. 5, pp. 617–622, 2010.
- [48] W. E. Sanders, "The occult dorsal carpal ganglion," *Journal of Hand Surgery*, vol. 10, no. 2, pp. 257–260, 1985.
- [49] K. H. Duncan and R. C. Lewis, "Scapholunate instability following ganglion cyst excision. A case report," *Clinical Orthopaedics and Related Research*, no. 228, pp. 250–253, 1988.
- [50] W. F. Kivett, F. M. Wood, G. E. Rauscher, and N. A. Taschler, "Does ganglionectomy destabilize the wrist over the long term?" *Annals of Plastic Surgery*, vol. 36, no. 5, pp. 466–468, 1996.



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