

Publication Trends in Surgical Treatment of Distal Radius Giant Cell Tumors Over the Past Five Years

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ABSTRACT

Background: Surgical interventions such as intralesional curettage until the complete excision and reconstruction require distal radius GCT treatment. However, to maintain the wrist function and reduce recurrent tendency, a more comprehensive understanding is needed to decide on the best therapeutic option as the standard strategy to achieve complete resection and functional outcomes. Therefore, this study aims to find the current treatment trends based on a literature study on distal radius GCT, emphasizing their potential outcomes.

Methods: The search strategy using the PubMed search engine (<https://pubmed.ncbi.nlm.nih.gov/>) was conducted on September 21, 2020, with the keywords: "distal radius giant cell tumor". The search resulted in 261 articles, and they were filtered by "published in the last five years," which yielded 67 articles. These articles then underwent further screening, resulting in 40 articles for the analysis.

Results: For article types, there were 27% (11/40) prospective studies, 32% (13/40) retrospective studies, 5% (2/40) systematic reviews, 27% (11/40) case reports, and 5% (2/40) case series. For the case series, more than ten cases were reported in both articles. There were 47 treatments in those total articles, and there were two types of GCT excision: intralesional curettage (extended and non-extended) (74.4%; 35/47) and en bloc (wide) resection (25.5%; 12/47).

Conclusions: The total number of articles published in the last five years on the distal radius increased in 2020. Most types of articles were retrospective studies, followed by case reports and prospective studies. The most common treatment published in the last five years is intralesional curettage than en bloc resection, with excellent results in intralesional curettage's functional outcome.

INTRODUCTION

A giant cell tumor (GCT) in bone is a benign bone tumor with locally invasive characteristics. It affects mainly in patients aged 20-40 years old. The usual site of this GCT is the distal radius [1,2]. The distal radius is indeed found to be the frequent site of recurrent GCT [3]. Wide excision is commonly used to decrease recurrent tendency rather than intralesional curettage, especially for an aggressive lesion of distal radius GCT [4]. However, with wide resection as the standard surgery adopted for this aggressive lesion, more complications will come as an unavoidable result [4,5]. In fact, wrist function is a highly demanding function, especially for young and active patients [6]. Hence, a

more comprehensive understanding is needed to decide on the best therapeutic options as a strategy to achieve complete resection as oncological and functional outcomes [7]. In this regard, different surgical techniques and modalities have been advocated previously to manage distal radius GCT. To that end, this study aimed to find the current treatment trends based on a literature study on distal radius GCT with particular emphasis on its potential outcome. Also, it may help orthopedic oncology surgeons concerning the suitable treatment options in distal radius GCT cases. In addition, this paper focuses on the current trends in the publications on distal radius GCT surgical management and their outcomes over the past five years and a literature review.

METHODS

The search strategy used the PubMed search engine (<https://pubmed.ncbi.nlm.nih.gov/>). It was conducted on September 21, 2020, with the term keywords “distal radius giant cell tumor”. The search yielded a total of 261 articles and filtered by “published in the last five years,” resulting in 67 articles. We specified the study characteristics in the distal radius giant cell tumor treatments in humans. The selected articles underwent further screening, and we excluded the same articles, inaccessible articles, non-English (Chinese) articles, and irrelevant articles due to incorrect anatomy and incorrect disease. Finally, we had 40 articles to be included in the analysis.

All human studies included all types of articles on the operative treatment of distal radius GCT, such as case reports, retrospectives, prospective, systematic reviews, meta-analyses, and therapeutic studies. Then, Microsoft Excel (Office 2019, Microsoft) was utilized for the database. Treatment strategy and demographic data were loaded and analyzed using Microsoft Excel. All selected articles were reviewed systematically and studied to find evidence of the methods using key questions formulated for their participants, interventions, study designs, outcomes, and critical appraisal. This study’s results were then also interpreted qualitatively.

RESULTS

The search resulted in a total of 261 articles and filtered by published in the last five years. We also excluded the same articles, inaccessible articles, and non-English-language articles, as shown in the flowchart (Figure 1).

Figure 2 shows the annual distribution of publications. The number of operative treatments on GCT distal radius articles was 40 in the last five years. The most significant number of publications was in 2020. Thus, there has been an increase in the number of articles published since 2015. Also, there were 37 active authors during five years (2015–2020).

For the article types, the most common study design was a retrospective study. There were 27% (11/40) prospective studies, 32% (13/40) retrospective studies, 5% (2/40) systematic reviews, 27% (11/40) case reports, and 5% (2/40) case series. For the case series, more than ten cases were reported in both articles (Figure 3).

There were 47 treatments in those total articles, and there were two types of GCT excision: intralesional curettage (extended and non-extended) (74.4%; 35/47)

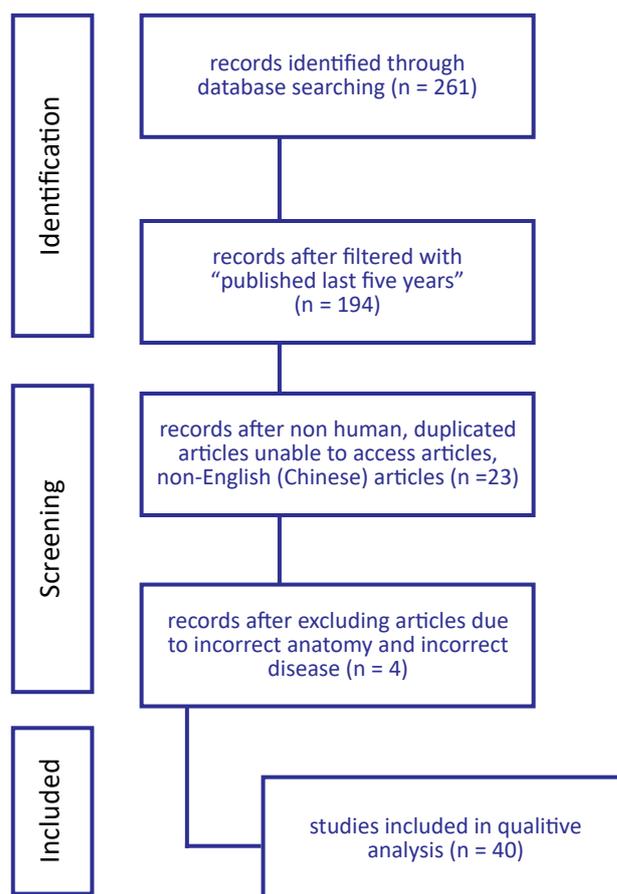


Figure 1. A flow diagram showing the results of the search process

and en bloc (wide) resection (25.5%; 12/47). It can be seen that the most common excision is intralesional curettage. All curettages were reconstructed with cementing. Meanwhile, en bloc resections were constructed using variable methods, such as prosthesis arthroplasty 17.1% (6/35), vascularized fibular graft 8.6% (3/35), non-vascularized fibular graft 28.6% (10/35), centralization ulna 8.6% (3/35), ulnar translocation 11.4% (4/35), radiocarpal arthrodesis 20% (7/35), and allograft 8.6% (3/35). The reconstructed treatment composition is described in Figure 4.

The outcome assessment of each treatment employed the musculoskeletal tumor society (MSTS) score, the disabilities of the arm, shoulder, and hand (DASH) score, the Mayo wrist score, and the visual analogue scale (VAS) to assess pain and GCT recurrence during follow-up.

Evaluation of the treatment based on the score used in each publication is shown in Table 1. The scoring system was used to assess the treatment outcome and also the result of each publication.

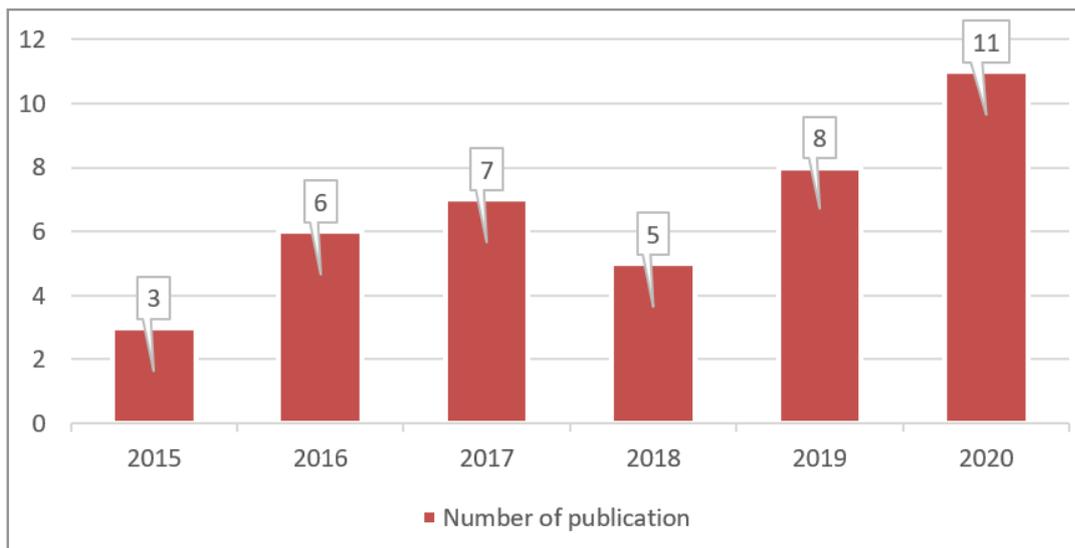


Figure 2. The number of Distal radius GCT operative treatment publications by year.

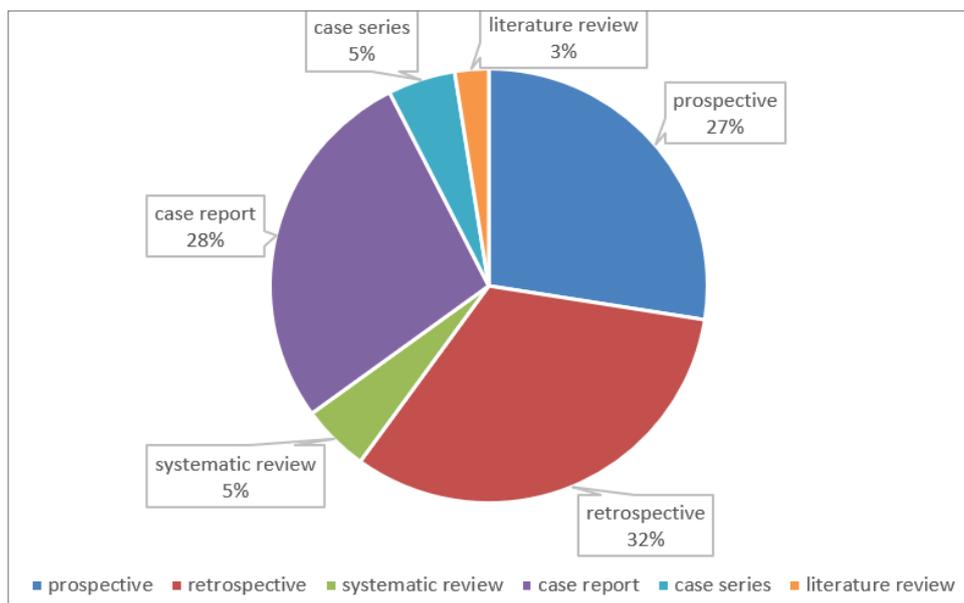


Figure 3. Article types in five years publication

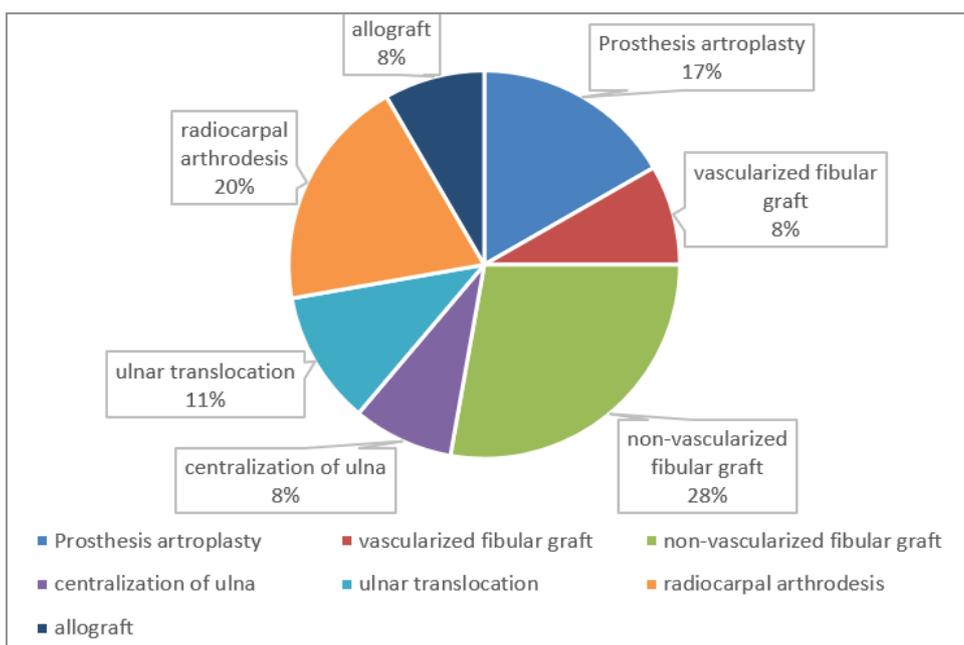


Figure 4. Reconstruction after en bloc resection

Table 1. The outcome of reconstruction after en bloc resection treatment based on each author's publication

Authors	Cases	Treatment	Outcome
Wang et al. [8]	39	en bloc resection and arthrodesis	union, DASH score 9, MSTS score 29
Zhang et al. [9]	11	en bloc resection and custom prosthetic replacement	MSTS score 80,3%
Qi et al. [10]	12	en bloc resection and reconstruction with non-vascularized proximal fibular autograft	Union MSTS 25.23, DASH 13
Yang et al. [11]	17	en bloc resection and reconstruction with vascularized proximal fibular autograft	Union pain-free excellent in functional
Zhang et al. [12]	8	en bloc resection and wrist arthrodesis reconstruction	Union DASH 48.9,
Zhang et al. [13]	27	en bloc resection and reconstruction with non-vascularized proximal fibular autograft	union MSTS 25.9%,
Meena et al. [14]	10	en bloc resection and wrist fusion through centralization of ulna	Union loss of wrist motion
Wang et al. [15]	10	en bloc resection and unipolar prosthesis	infection complication occasional pain
Shanchez-Torres et al. [16]	1	en bloc resection and ulnar centralization and ulnocarpal arthrodesis	union, limited function painless
Mozaffarian et al. [17]	7	en bloc resection and proximal fibular arthroplasty	none recurrent good function
Cao et al. [18]	48	en bloc resection and reconstruction with non-vascularized proximal fibula	Union
Wiratnaya et al. [19]	1	en bloc resection and reconstruction with non-vascularized fibular graft	Union DASH 9.2, Mayo 90
Salunke et al. [20]	25	en bloc resection and reconstruction with ulnar translocation and wrist ulnocarpal arthrodesis	MSTS 24, union
Luchetti et al. [21]	1	en bloc resection and reconstruction with iliac bone allograft and radiocarpal arthrodesis	Union
Lu et al. [22]	11	en bloc resection and reconstruction with an uncemented 3D printed titanium prosthesis	reduced pain DASH 18.7, Mayo 72, no complication
Vyas et al. [23]	20	en bloc resection and reconstruction with translocation of ulna	Union good functional outcome
Qu et al. [24]	21	en bloc resection with wrist arthrodesis	MSTS 93 arthrodesis better grip strength and functional outcome than arthroplasty
Gulia et al. [25]	12	en bloc resection and reconstruction with wrist arthroplasty	MSTS 93
Ruatti et al. [26]	1	en bloc resection and reconstruction with wrist arthrodesis	union, MSTS 25,
		en bloc resection and allograft reconstruction	MTS score 88%, DASH 6, good functional and grip union

Authors	Cases	Treatment	Outcome
Abuhejleh et al. [27]	23	en bloc resection and arthrodesis	MSTS 27
	37	en bloc resection and internal fixation and fibular autograft	MSTS 27 recurrent 10, non-union 5,
Barik et al. [28]	11	en bloc resection and reconstruction with non-vascularized proximal fibula	Mayo 66.36, MSTS score 21.09 (18-24),
Bianchi et al. [29]	47	en bloc resection and reconstruction with non-vascularized fibular graft	DASH score 33.9 MSTS score 21
	20	en bloc resection and wrist arthrodesis	DASH score 40.2 MSTS score 21
Chobpentai et al. [30]	90	en bloc resection and reconstruction with ulna transposition	MSTS score 30 (78-87)
Kamal et al. [31]	12	en bloc resection and reconstruction with non/vascularized proximal fibular autograft	MSTS score 100 in vascularized fibular graft, MSTS score 77.7 in non-vascularized fibular graft,
Handel et al. [32]	1	en bloc resection and vascularized ulnar transposition and radioscapulohumeral fusion	pain relieved DASH 15.5
Kapoor et al. [33]	1	en bloc resection and reconstruction with centralization of the ulna and ulnocarpal fusion	MSTS 15
Damert et al. [34]	1	en bloc resection and reconstruction with custom made wrist prosthesis (UNI-2, Germany)	DASH 27, pain-free
Wang et al. [35]	15	en bloc resection with allograft reconstruction	VAS 4.3, Mayo 47.3, MSTS 17.1,
	15	en bloc resection with cementless 3D printed prosthesis reconstruction	Mayo 51.7 MSTS 28,6% VAS 4.2
Marshall et al. [36]	1	en bloc resection and allograft reconstruction	MSTS 27

MSTS, musculoskeletal tumor society score; DASH, the disabilities of the arm, shoulder, and hand score; VAS, visual analogue scale

DISCUSSION

In the community, the distal radius is the third most common location for GCT after the distal femur and proximal tibia [8]. The surgical options for patients with this distal radius GCT vary [8,9]. In addition, the publication of distal radius GCT has had an increasing trend since 2015 (**Figure 1**). Based on the PubMed database, the number of publications on distal radius GCT surgical treatment in 2020 was approximately four times that of 2015. Most of the articles were retrospective studies and case reports. However, the number of samples in these retrospective studies was under 50 cases, indicating that distal radius GCT is still rare. One article had a systematic review of reconstruction with ulnar transposition in 90 cases, and the MSTS score was 30 in the outcome.

On the other hand, intralesional curettage, cementing, with or without bone graft, is the most common treatment for Campanacci I and II lesions [30]. However,

Campanacci III or recurrent GCT is treated with en bloc resection [35]. Therefore, in Campanacci III and en bloc resection, reconstruction of the distal radius is recommended [35]. Several reconstruction methods for distal radius after en bloc resection include prosthesis arthroplasty, vascularized fibular graft, non-vascularized fibular graft, centralization ulna, ulnar translocation, radiocarpal arthrodesis, and allograft [20-25]. As seen in **Figure 3**, the most reconstructive option in the five-year publication used a non-vascularized fibular graft.

Furthermore, the median MSTS score of non-vascularized fibular grafts was approximately 24-27, but not all non-vascularized fibular graft reconstruction articles provided the MSTS score data. Besides, radiocarpal arthrodesis is also popular among these five-year publications. Radiocarpal arthrodesis after en bloc resection and bone graft has good results in relieving pain, union rate, and grip strength, but the range of motion should be limited. In addition, prosthesis arthroplasty is also popular in the last five years

publications on customized like 3D printing titanium or non-customized [34–35]. The excellent outcomes were presented in customized arthroplasty, such as pain-free and good functional scores. In unipolar arthroplasty, they reported outcomes with complications and occasional pain [15].

Meanwhile, the less popular reconstructions were allograft and ulna centralization. However, both reconstruction types are also beneficial for decreasing pain and functional outcome. Even the reconstruction types after en bloc resection vary; the most published article in these five years is intralesional curettage to treat distal radius GCT. Almost all articles showed the most significant functional outcomes after the treatment. However, the recurrent of GCT is still reported after intralesional curettage [27].

CONCLUSIONS

The total number of articles in the last five years on the distal radius increased in 2020. Most article types were retrospective studies, followed by case reports and prospective studies. In the last five years, the most published treatment is intralesional curettage than en bloc resection, with excellent results in the intralesional curettage's functional outcome. However, treatment choices for reconstruction after en bloc resection vary. In the last five years, the most popular reconstruction uses a non-vascularized fibular graft, which also results in pain relief and functional outcomes. However, this study only presented data in the last five years. For this reason, it is necessary to conduct a comprehensive study to make the right treatment choice for distal radius GCT.

DECLARATIONS

Ethics approval

Ethical approval was issued by the Ethical Committee of Faculty of Medicine, Universitas Sebelas Maret

Competing interest

The authors declare no competing interest in this study

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