Left and Non-Dominant Shoulders Were More Frequently Affected in Patients with Frozen Shoulder: A Systematic Review and Meta-Analysis

Katsuhiro Toda*
Department of Orthopedic Surgery, Kitahiroshima Town Toyohira Hospital, Hiroshima, 731-1222, Japan

Abstract

**Background:** If trauma has a considerable impact on frozen shoulder, the right or dominant shoulder is more frequently affected than the left or non-dominant shoulder. Herein it is examined whether the right or dominant shoulder was more frequently affected in patients with frozen shoulder using PubMed.

**Materials and methods:** PubMed was searched to retrieve relevant studies. The search term used was "frozen shoulder." The studies obtained were published between 1966 and 2007, and included 10 or more patients with only one affected side. Patients with bilateral shoulder involvement were excluded.

**Results:** The right shoulder was affected in 718 patients (46.3%), while the left shoulder was affected in 833 (53.7%). The dominant shoulder was affected in 298 patients (41.1%), while the non-dominant shoulder was affected in 427 (58.9%). The left shoulder was affected significantly more than the right shoulder (p<0.01). The non-dominant shoulder was affected significantly more than the dominant shoulder (p<0.01).

**Conclusion:** Trauma including repeated minor trauma is less likely to cause frozen shoulder, or the influence of brain abnormalities is stronger than that of trauma. The left shoulder may have been more frequently affected because of the side-to-side asymmetry of the brain for various reasons. If this hypothesis is correct, brain abnormalities may be one cause of frozen shoulder, suggesting that central neuropathic pain or braingenic pain contributes to the pain associated with frozen shoulder. The right and dominant shoulders were less frequently affected in patients with frozen shoulder.

Keywords: Frozen shoulder; Side-to-side asymmetry; Dominant hand; Right; Left; Frequency

Introduction

Trauma including repeated minor trauma may cause frozen shoulder [1]. If trauma has a considerable impact on frozen shoulder, the right or dominant shoulder is more frequently affected than the left or non-dominant shoulder. Herein it is examined whether the right or dominant shoulder was more frequently affected using PubMed.

Materials and Methods

PubMed was searched to retrieve relevant studies. The search term used was "frozen shoulder." The following inclusion criteria were employed: (1) Studies published between 1966 and 2007; (2) Studies written in English; (3) Studies including 10 or more patients with only one affected side. Patients with bilateral shoulder involvement were excluded; (4) Studies comprising full reports (no letters or abstracts); (5) If one group published 2 or more studies, only one study with the largest number of patients was used; (6) The study by Weiser [2] reported the following: the left and right side were equally involved (n=100). The study by Bunker et al. [3] demonstrated that "The left and right side were equally involved (n=50). Therefore, the right side is considered to be involved in 50% of patients in these studies [2,3] (Figure 1). The goodness-of-fit test was applied. A P value<0.01 was considered to be significant.

Results

The right shoulder was affected in 718 patients (46.3%), while the left shoulder was affected in 833 (53.7%). The dominant shoulder was affected in 298 patients (41.1%), while the non-dominant shoulder was affected in 427 (58.9%). The left shoulder was affected significantly more than the right shoulder (p<0.01). The non-dominant shoulder was affected significantly more than the dominant shoulder (p<0.01) (Table 1).

![Inclusion criteria](image)

| PubMed: Frozen shoulder Published: 1966-2007 Written in English ≥10 patients with one affected side Full report (no letters or abstracts) |
|---|

Exclusion criteria

| If one group published 2 or more studies, only one study with the largest number of patients was used. |

Results

| Right: 718 (46.3%) | Left: 833 (53.7%) |
|---|---|
| Dominant: 298 (41.1%) | Non-dominant: 427 (58.9%) |

Discussion

The cause of frozen shoulder currently remains unknown. A systematic review showed that the pathophysiology associated with

*Corresponding author: Dr. Katsuhiro Toda, Department of Orthopedic Surgery, Kitahiroshima Town Toyohira Hospital, 4705, Azaka, Kita-Hiroshima Town, Yamagata-Gun, Hiroshima, 731-1222, Japan, Tel: +81-826-84-1155; E-mail: goutatack@yahoo.co.jp

Received June 01, 2018; Accepted June 28, 2018, Published July 05, 2018

Citation: Toda K (2018) Left and Non-Dominant Shoulders Were More Frequently Affected in Patients with Frozen Shoulder: A Systematic Review and Meta-Analysis. Orthop Muscular Syst 7: 258. doi:10.4172/2161-0533.1000258

Copyright: © 2018 Toda K. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
primary (idiopathic) frozen shoulder was inconclusive [4]. Trauma including repeated minor trauma may cause frozen shoulder [1]. If this hypothesis is correct, the right or dominant shoulder is more frequently affected. However, in contrast to predictions, the left and non-dominant shoulders were more frequently affected. Trauma including repeated minor trauma may be less likely to cause frozen shoulder, while the influence of brain abnormalities appears to be stronger than that of trauma.

It currently remains unclear why the left and non-dominant shoulders are more frequently affected. Based on previous findings, Merskey et al. reported that pain was more often lateralized on the left, except in the case of trigeminal neuralgia [5]. Previous experimental evidence implied that the right hemisphere was less efficient than the left in processing cutaneous sensory input [5]. Ertunc et al. reported that the herpes zoster infection frequency was higher in right-handed patients and more frequently appeared in the left body side of females [6]. Dane et al. showed that the cell-mediated hypersensitivity was stronger in the left side of the body than the right based on the tuberculin test with 22 male and 36 female healthy high school students [7]. The left shoulder may have been more frequently affected by frozen shoulder because of the side-to-side asymmetry of the brain for various reasons. If this hypothesis is correct, brain abnormalities are one of the causes of frozen shoulder, suggesting that central neuropathic pain or braingenic pain contributes to the pain associated with frozen shoulder.

The non-dominant shoulder (58.9%) was more frequently affected than the left shoulder (53.7%). The reason for this remains unknown. It may be due to the roles of the right brain in right-handedness and those of the left brain in left-handedness not necessarily being the same, as well as the roles of the right brain in left-handedness and those of the left brain in right-handedness not necessarily being the same [2,3,8-42].

Limitations

Some physicians may believe that trauma including repeated minor trauma causes frozen shoulder. These physicians may be more likely to think that the right or dominant shoulder is more frequently affected than the left or non-dominant shoulder. Therefore, in case that the left or non-dominant shoulder is more frequently affected than the right or
dominant shoulder, it is possible that they are more likely to interested in it and report it. These may cause a bias.

Conclusion

The right shoulder was affected in 718 patients (46.3%), while the left shoulder was affected in 833 (53.7%). The dominant shoulder was affected in 298 patients (41.1%), while the non-dominant shoulder was affected significantly more than the right shoulder (p<0.01). The non-dominant shoulder was affected significantly more than the dominant shoulder (p<0.01).

Conflict of Interest

The author confirms that this article content has no conflict of interest.

Acknowledgement

I thank Medical English Service for reviewing this manuscript.

References

1. Harryman DT, 2nd (1993) Shoulders: Frozen and stiff. Instr Course Lect 42: 247-257.
2. Weiser HI (1977) Painful primary frozen shoulder mobilization under local anesthesia. Arch Phys Med Rehabil 58: 406-408.
3. Bunker TD, Anthony PP (1995) The pathology of frozen shoulder. A Dupuytren-like disease. J Bone Joint Surg Br 77: 677-683.
4. Ryan V, Brown H, Minns Lowe CJ, Lewis JS (2016) The pathophysiology associated with primary (idiopathic) frozen shoulder: A systematic review. BMC Musculoskelet Disord 17: 340.
5. Merskey H, Watson GD (1979) The lateralisation of pain. Pain 7: 271-280.
6. Ertunc V, Dane S, Karakuzu A, Deniz O (1997) Higher herpes zoster infection frequency in right-handed patients and more frequent appearance in the left body side of females. Acta Derm Venereol 77: 245.
7. Dane S, Erdem T, Gumustekin K (2001) Cell-mediated immune hypersensitivity is stronger in the left side of the body than the right in healthy young subjects. Percept Mot Skills 93: 329-332.
8. Lundberg BJ (1969) The frozen shoulder: Clinical and radiographical observations. The effect of manipulation under general anesthesia, structure and glycosaminoglycan content of the joint capsule, local bone metabolism. Acta Orthopaed Scand Suppl 119: 1-59.
9. Reeves B (1975) The natural history of the frozen shoulder syndrome. Scand J Rheumatol 4: 193-196.
10. Heitberg B, Wagner P, Dohler R (1983) Mobilization of frozen shoulder under general anesthesia. Acta Orthop Belg 49: 267-274.
11. Bulgen DY, Binder AI, Hazleman BL, Dutton J, Roberts S (1984) Frozen shoulder: Prospective clinical study with an evaluation of three treatment regimens. Ann Rheum Dis 43: 353-360.
12. Parker RD, Froimson AI, Winsberg DD, Ansham NZ (1989) Frozen shoulder. Part II: Treatment by manipulation under anesthesia. Orthopedics 12: 989-990.
13. Hsu SY, Chan KM (1991) Arthroscopic distension in the management of frozen shoulder. J Shoulder Elbow Surg 10: 353-357.
14. Weber M, Prim J, Bugglin R, Michel BA, Gerber H (1995) Long-term follow-up to patients with frozen shoulder after mobilization under anesthesia, with special reference to the rotator cuff. Clin Rheumatol 14: 686-691.
15. Melzer C, Walling T, With CJ, Hoffman S (1995) Frozen shoulders: treatment and results. Arch Orthopa Trauma Surg 114: 87-91.
16. Gam AN, Schydowsky P, Rossel I, Remvig L, Jensen EM (1998) Treatment of “frozen shoulder” with distension and glucocorticoid compared with glucocorticoid alone. A randomised controlled trial. Scand J Rheumatol 27: 425-430.
17. Leppala J, Kannus P, Sievanen H, Jarvinen M, Vuori I (1998) Adhesive capsulitis of the shoulder (frozen shoulder) produces bone loss in the affected humerus, but long-term bony recovery is good. Bone 22: 691-694.
18. Reichnister JP, Friedman SL (1999) Long-term functional results after manipulation of the frozen shoulder. Md Med J 48: 7-11.
19. O’Kane JW, Jackins S, Sidles JA, Smith KL, Matsen FA (1999) Simple home program for frozen shoulder to improve patients’ assessment of shoulder function and health status. J Am Board Fam Pract 12: 270-277.
20. Okamura K, Ozaki J (1999) Bone mineral density of the shoulder joint in frozen shoulder. Arch Orthopa Trauma Surg 119: 363-367.
21. Watson L, Daizel R, Story I (2000) Frozen Shoulder: A 12-month clinical outcome trial. J Shoulder Elbow Surg 9: 16-22.
22. Dodenhoff RM, Levy O, Wilson A, Copeland SA (2000) Manipulation under anesthesia for primary frozen shoulder: effect on early recovery and return to activity. J Shoulder Elbow Surg 9: 23-26.
23. Carter B (2001) A pilot study to evaluate the effectiveness of Bowen technique in the management of clients with frozen shoulder. Complement Ther Med 9: 208-215.
24. Omari A, Bunker TD (2001) Open surgical release for frozen shoulder: Surgical findings and results of the release. J Shoulder Elbow Surg 10: 353-357.
25. Klinger HM, Otte S, Baums MH, Haerer T (2002) Early arthroscopic release in refractory shoulder stiffness. Arch Orthopa Trauma Surg 122: 200-203.
26. Vermeulen HM, Stokdijk M, Eilers PH, Meskers CG, Rozing PM, et al. (2002) Measurement of three dimensional shoulder movement patterns with an electromagnetic tracking device in patients with a frozen shoulder. Ann Rheum Dis 61: 115-120.
27. Massoud SW, Pearse EO, Levy O, Copeland SA (2002) Operative management of the frozen shoulder in patients with diabetes. J Shoulder Elbow Surg 11: 609-613.
28. Halverson LM, Maas R (2002) Shoulder joint capsule distension (hydroplasty): A case series of patients with “frozen shoulders” treated in a primary care office. J Fam Pract 51: 61-63.
29. Olthman A, Taylor G (2002) Manipulation under anaesthesia for frozen shoulder. Int Orthop 26: 268-270.
30. Hamdan TA, Al-Essa KA (2003) Manipulation under anaesthesia for the treatment of frozen shoulder. Int Orthop 27: 107-109.
31. Rundquist PJ, Anderson DD, Guanche CA, Ludewig PM (2003) Shoulder kinematics in subjects with frozen shoulder. Arch Phys Med Rehabil 84: 1473-1479.
32. Buchbinder R, Hoving JL, Green S, Hall S, Forbes A, et al. (2004) Short course prednisolone for adhesive capsulitis (frozen shoulder or stiff painful shoulder): A randomised, double blind, placebo controlled trial. Ann Rheum Dis 63: 1460-1469.
33. Widiastuti-Samekto M, Sianturi GP (2004) Frozen shoulder syndrome: Comparison of oral route corticosteroid and intra-articular corticosteroid injection. Med J Malaysia 59: 312-316.
34. Khan AA, Mowla A, Shakoor MA, Rahman MR (2005) Arthrographic distension of the shoulder joint in the management of frozen shoulder. Myrmensingh Med J 14: 67-70.
35. Ma T, Kao MJ, Lin IH, Chiu YL, Chien C, et al. (2006) A study on the clinical effects of physical therapy and acupuncture to treat spontaneous frozen shoulder. Am J Chin Med 34: 759-775.
36. Ryu JD, Kipralani PA, Kim JM, Nam KH, Han CW, et al. (2006) Expression of vascular endothelial growth factor and angiogenesis in the diabetic frozen shoulder. J Shoulder Elbow Surg 15: 679-685.
37. Kivimaki J, Pohjolainen T, Malmivaara A, Kannisto M, Guillaume J, et al. (2007) Manipulation under anaesthesia with home exercises versus home exercises alone in the treatment of frozen shoulder: A randomized, controlled trial with 125 patients. J Shoulder Elbow Surg 16: 722-726.
38. Amir-Us-Saqlain H, Zubairi A, Taufiq I (2007) Functional outcome of frozen shoulder after manipulation under anaesthesia. J Pak Med Assoc 57: 181-185.
39. Baums MH, Spahr G, Nozaki M, Steckel H, Schultz W, et al. (2007) Functional outcome and general health status in patients after arthroscopic release in adhesive capsulitis. Knee Surg Sports Traumatol Arthrosc 15: 630-644.
40. Sakeni RA, Al-Nimer MS (2007) Comparison between intra-articular triamcinolone acetone and methylprednisolone acetate injections in treatment of frozen shoulder. Saud Med J 28: 707-712.
41. Yang JL, Chang CW, Chen SY, Wang SF, Lin JJ (2007) Mobilization techniques in subjects with frozen shoulder syndrome: Randomized multiple-treatment trial. Phys Ther 87: 1307-1315.