

RADIAL FOREARM ISLAND FLAP IN THE MANAGEMENT OF SEVERE ADDUCTION CONTRACTURE OF THUMB

G. S. KALRA, S. K. BHATNAGAR, R. CHANDRA AND S. D. PANDEY

SUMMARY

The use of radial forearm flap as a distally based island flap for severe adduction contracture of thumb is being presented. The advantages and vascular basis of this flap has been discussed.

Adduction contracture of the thumb is the sequale of scar contracture following wound healing by secondary intention. It involves the muscles, fascia, and other landmarks secondarily. This raw area may be due to burns, trauma and other injuries. It is the lack of proper management i.e. replacement of tissue loss, proper immobilisation and physiotherapy which leads to this crippling deformity (Fig 1).

In order to restore mobility of the thumb it is not only necessary to release skin, but also the connective tissue and muscle as well (Fig 2). Less severe cases can easily be managed by dermoepithelial free grafts, local flaps from dorsum of index finger (Brown, 1972), thumb (Strauchs, 1975) or single or multiple Z-plastics (Woolf et al., 1972; Hirshowitz et al., 1975). In the more severe cases, however, a large amount of skin and subcutaneous tissue taken as distant flap have been used. Distant flap from abdomen (Bunnell, 1964; Littler, 1959; Mura, 1973) and contralateral upper arm (Bonola & Fiocchi, 1975) have been used for the web space constitution. Resurfacing by distant flap is a time consuming multi-stage procedure and it is difficult to maintain position of thumb in maximum abduction during the flap transfer.

The radial forearm flap has been used as a free flap (Yang et al., 1981; Show, 1981; Song, 1982; Chang, 1982; Soutar et al., 1983) and distally based island flap (Souter et al., 1984; Biemer et al., 1984). When this flap is used as pedicled flap, its pedicle comprises

of radial artery, venae comitantes and cephalic vein. It provides thin, non-hairy skin suitable for hand defects.

We have used distally based island flap for severe adduction contracture as a single stage procedure.

Vascular Basis of Radial Forearm flap

The radial forearm flap is a fasciocutaneous flap based on radial artery which together with its two venae comitantes lies invested in the condensation of the deep fascia known as the lateral inter-muscular septum. It separates the flexor and extensor compartments of the forearm and is attached to the periosteum of the radius distal to the insertion of pronator teres. The artery gives off certain branches which spread out into the deep fascia to form a fascial plexus and via this fascial plexus the radial artery can supply the skin of the volar and radial aspect of the forearm and provide a periosteal blood supply to the distal radius.

When this flap is used as island flap, pedicled distally, (Fig 4-5) the normal arterial blood flow is reversed and the flap relies on a retrograde blood flow from the ulnar artery provided via palmar arch. Venous blood flow is also reversed, which appears to indicate relative lack of valves in the venae comitantes and an abundant venovenous anastomatic network between both venae comitantes and the superficial veins (Souter & Tanner, 1984).

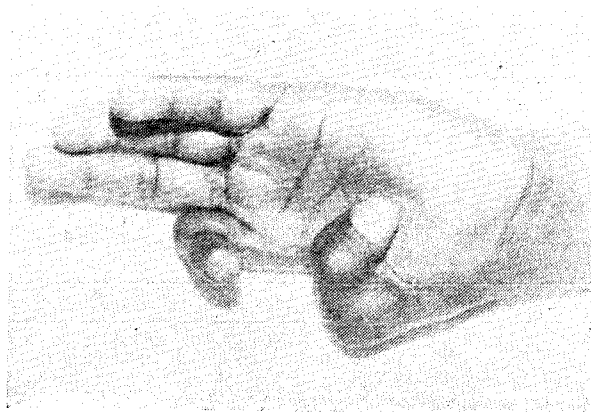


Fig. 1. A patient with severe adduction contracture of thumb.

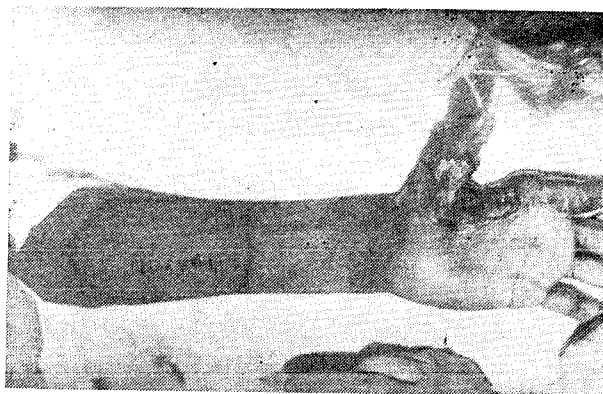


Fig. 2. Contracture released, Radial artery and flap marked.



Fig. 3. Flap has been elevated and pedicle dissected distally.



Fig. 4. Flap tunneled through subcutaneous tunnel, Radial N. has been saved (arrow).

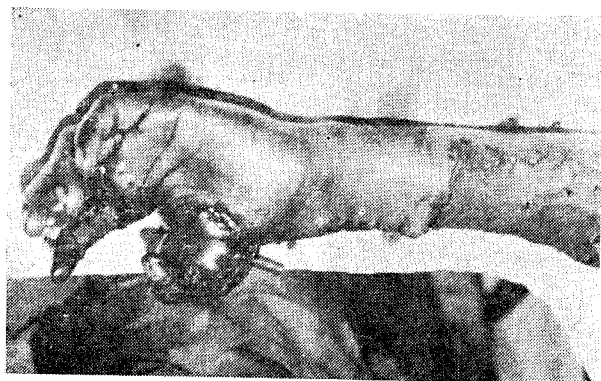


Fig. 5. Flap has been set in. Flap shows oedema.



Fig. 6. Post-operative result after 6 weeks.

Material and Methods

Five cases of severe adduction contracture of thumb (Table 1) were selected for the study. Pre-operative Allen test was done to see patency of palmar arch. Post-operatively hand was immobilized in functional position with thumb in maximum possible abduction. Cast was discarded on 15th post-operative day when active physiotherapy was started.

Table 1.

No. of Case	Age	Sex	Cause of Contracture	Size of the Flap
1.	35 Yrs.	M	Burn	8×5 cm.
2.	20 Yrs.	M	Crush injury	10×7 cm.
3.	18 Yrs.	M	Crush injury	7.5×4.5 cm.
4.	30 Yrs.	M	Electric Burn	3×4 cm.
5.	45 Yrs.	M	Crush injury	8.5×5.0 cm.

Observations

In five patients with severe adduction contracture of the thumb, radial forearm island flap was used to reconstruct the 1st web space after its proper release (Fig. 1-5). Swelling of the flap was encountered (Fig 5) in all patients but it reduced itself in 3 weeks. No necrosis of the flap was encountered, the donor area in two cases had some skin loss over the tendons which healed in 2-3 weeks. Good functional

results of the thumb were attained by all patients.

Discussion

Release of severe adduction contracture of thumb requires a distant flap cover. Use of groin flap (Lister et al., 1973), abdominal flap (McGregor, 1979; Mura, 1979) cross-arm flap (Banola, 1975) in hand surgery have been described. These methods require the attachment of limb to another part of body with unavoidable restriction in the mobility of the limb, oedema is difficult to control particularly in the dependant positions of the abdomen and groin.

Free flaps can be used but have technical difficulties, require microsurgical expertise and prolonged operating time.

The development of the radial forearm flap has made available a large amount of local tissue (Table 1) which can be used as a vascular island flap to reconstruct the hand. The flap is easy to raise and does not require any microsurgical expertise. Pre-operative Allen test to see the patency of palmar arch is a pre-requisite because flap survives on the retrograde blood supply from ulnar artery.

Post-operative freedom permits postural control of oedema and thumb can be immobilized in abduction easily by dynamic or fixed splint. Early physiotherapy and mobilisation of the hand is possible.

Acknowledgement

The authors are very thankful to Dr. Pramod Kumar, Chief resident in Plastic Surgery, at the King George's Medical College, Lucknow for making valuable suggestions in preparation of this paper.

REFERENCES

1. BANOLA, R. AND FIOCCHI, R. : Cross-arm double flap in the repair of severe adduction contracture of the thumb. *The Hand* 1975; 7 : 287.
2. BEIMER, E. AND STOCK, W. : Total thumb reconstruction : a one stage reconstruction using an osteocutaneous forearm flap. *British J. Plast Surg.* 1985; 36 : 52.
3. BROWN, P. W. : Adduction flexor contracture of the thumb. *Clinical Orthopaedics & Related Research.* 1972 88 : 161.

4. BUNNELL, S. : Surgery of the hand, 4th ED. Philadelphia, J. B. Lippincott, 1964, pp. 196-231, 243, 531.
5. CHANG, T. S., WANG, W. AND HSU, C. V. : The free forearm flap : A report of 25 cases. Ann. Academy. Med. Singapore 1982; 11 : 236.
6. HIRSHOWITZ, B., KARAV, A. AND ROUSSO, M. : Combined double Z-plasty with Y-V advancement for thumb web contracture. The hand, 1975; 7 : 291.
7. LISTER, G. D., MCGREGOR, I. A. AND JACKSON, I. T. : The groin flap in hand injury. Injury 1973; 4 : 229.
8. LITTLER, J. W. : Prevention and correction of adduction contracture of the thumb. Clinical Orthopaedics 1959; 13 : 182.
9. MCGREGOR, I. A. : Fasciocutaneous flaps in intra oral reconstruction. Clinics in Plastic Surgery 1985; 12, 453.
10. MURA, T. : Use of paired abdominal flaps for release of adduction contracture of thumb. Plast. Reconst. Surg, 1979; 63 : 242-44.
11. SONG, R., GAO Y., SONG, Y., AND YU, Y. : The forearm flap. Clinics in Plastic Surg. 1982; 9, 21.
12. SOUTAR, D. S., SCHEKER, C. R., TANNER, N. S. B. AND MCGREGOR, I. A. : The Radial forearm flap : A versatile method of intra oral reconstruction, British. J. Plast. Surg, 1983; 36 : 1.
13. SOUTAR, D. S. AND TANNAR, N. S. B. : The radial forearm flap in the management of soft tissue injury of the hand. British J. Plast. Surg. 1984; 37 : 16.
14. STRAUCH, B. : Dorsal thumb flap for release of adduction contracture of the 1st web space. Bul. Hosp. Joint. Dis, 1975; 36 : 34.
15. TIMMONS, M. J., MISSOTTEN, F. E. M., POOLE, M. D. AND DAVIS, M. D. : Complications of radial forearm flap donor sites. British. J. Plast. Surg. 1986; 2 : 176-178.
16. WROLE, R. M. AND BROADBENT, T. R. : The four Z-Plasty. Plast. Reconst. Surg, 1972; 49 : 48-51.
17. YONG GUOFAM, et. al. : Forearm free skin flap transplantation. National Medical J. of China 1981, 61, 139. Abstracted in Plast. Reconst. Surg. 1982; 69 : 1041.

The Authors

DR. G. S. KALRA, M.S., D.N.B. *Senior Resident*, Postgraduate Department of Plastic Surgery, K. G. Medical College, Lucknow.

DR. S. K. BHATNAGAR, M.S., M.Ch., M.N.A.M.S., F.I.C.S. *Lecturer*, Postgraduate Department of Plastic Surgery, K. G. Medical College, Lucknow.

PROF. RAMESH CHANDRA, M.S., M.S. F.R.C.S. *Professor & Head*, Postgraduate Department of Plastic Surgery, K. G. Medical College, Lucknow.

DR. S. D. PANDEY, M.S., M.Ch. *Reader*, Postgraduate Department of Plastic Surgery, K. G. Medical College, Lucknow.

Request for Reprints

DR. S. K. BHATNAGAR, F-2314, Rajaji Puram, Tal Katora, Lucknow-226 017, India.