CASE SERIES

Two-Stage Flexor Tendon Reconstruction in Zone II Using Paediatric Silicon Catheter at Mayo Hospital Lahore: A Case Series

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Abstract

The aim of the study was to assess the functional outcomes after two stage flexor tendon reconstruction in zone II tendon injury of the hand using paediatric silicon catheter. A prospective case series of total 22 digits of 21 patients having Boyes grades I, II and III neglected flexor tendon injury, for a mean time of 10 months since injury were included. Two stage reconstructive procedure was performed. A final follow-up was done at one year to assess the functional outcome using Buck-Gramcko scale. Out of 22 digits, there were 06 (27.27%) Boyes grades I digits, 11 (50%) grades II and 5 (22.72%) grades III. At final follow-up thirteen (59.09%) digits had excellent, five (22.72%) had good while three (13.63%) had satisfactory result and one (4.54%) had poor result. We concluded that two stage flexor tendon reconstruction using silicon catheter yields good results and is cost effective.

Keywords: Two staged flexor tendon reconstruction, Pediatric Silicon catheter, zone II injury.
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Introduction

The flexor tendon reconstruction in zone II of the hand remains a challenge for the hand surgeons. Flexor tendon injuries occur after road traffic accident (RTA), occupational hazards and direct trauma to the hand. Paneva-Holevich[1] in 1965 for the first time described the method of reconstruction of the flexor tendon injuries in no man's land in acute and neglected injuries. He made a loop between the flexor digitorum profundus (FDP) and flexor digitorum superficialis (FDS) distal ends and then reflecting the proximal end of FDS as pedicled graft after 8 to 12 weeks.[1] Hunter and Salisbury in 1971 for the first time did two stage flexor tendon reconstructions, using the flexible Silicone-Dacron rod in first stage and later using a free tendon graft through the pseudo sheath formed around the silicone rod in second stage.[2]

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Kessler et al[3] first published a combination of Hunter and Paneva-Holevich techniques. Literature reported combined methods have been done and published.[4] Beris et al[5] and Abdul Kadir et al[6] did two stage flexor tendon reconstructions found excellent and good results according to Buck-Gramcko scale

The silicone Foley's catheter has not been used before for reconstruction of pseudo sheath. The rationale to use paediatric silicon catheter was that it is economical and easily available in local market. We carried out this study to assess the functional outcome in flexor tendon reconstruction in two stage tendon reconstruction using silicone Foley's catheter instead of silicone rod (Hunter rod) in zone II flexor tendon injury by Buck-Gramcko scale.[7] The zone II tendon injury was graded by Boyes and Stark which was later modified by Wehbe et al.[8]

Case Series

Methodology: This prospective case series was conducted at Department of Orthopaedic Surgery and Traumatology Unit-I, Mayo Hospital, Lahore using non-probability purposive sampling technique from June 2010 to February 2015. Our sample size was 21 patients with 22 digits. All patients with neglected injuries to flexor tendons in zone II with loss of active flexion and presence of full range of passive movement at metacarpo-phalangeal, proximal inter-phalangeal, and distal inter-phalangeal joints evaluated on history, clinical examination and Boyes and Stark grading modified by Wehbe et al[8] grade I, II and III were included. All patients with Boyes grade IV and V, previous surgery and extensor tendon injury were excluded. The mean interval between the first stage and injury was 10 months (ranged from 3 months to 18 months).

Procedure: After preoperative antibiotic, Bruner zigzag incision was made on the finger on palmer side extending in the palm up to zone II of hand.[9] The A-2 and A-4 pulleys were preserved or reconstructed. A silicone catheter of size 8 or10 depend on the size of a finger was then passed through the pulleys and was sutured distally to remaining

Figure-1: (a) Brunner Incision to expose pulleys in zone II. (b) Paediatric Silicon catheter is inserted saving A2 and A4 pulleys.

FDP stump. The proximal end of the catheter was left free in palm (because we wanted passive range of movement of the finger and if the proximal end is attached then ROM is not possible). Post-operatively, patients were discharged on next day on oral antibiotics. Follow up was done on 2nd, 4th, 8th and 12 weeks. Passive range of motion exercises were started on the second post op day till 12 to 14 weeks by the patient himself using contralateral hand to avoid joint stiffness (active range of movement is not possible at this stage because there is no tendon inside for active movement).

Stage II was performed 12 to 14 weeks after stage I, when full passive range of movements at MP, DIP, and PIP joints was obtained. Incision was made in the palm and proximal end of the silicon catheter was exposed and the distal end of the FDP also identified in pulp of finger.

Free tendon graft of appropriate size was taken either from palmaris longus (in 17 patients) or from plantaris (in 4 patients) with tendon stripper and was sutured end to end with the distal end of FDP using four strand technique with non-cutting proline 4/0.Then the distal end of the graft was sutured with the proximal end of silicone catheter. A second incision was made on the palmer surface of finger pulp and the distal end of the silicone catheter was identified. The distal end was freed with gentle traction applied on the catheter. The tendon graft was pulled through the new pseudo-sheath and was delivered. The free distal end was then attached to distal phalanx by anchoring pull out suture over a button on the nail. Klienert splint was used for dynamic physiotherapy for six weeks.[10] Controlled mobilization i.e. active extension and passive flexion was started on second post op day and active unprotected ROM is allowed after six weeks.

The patients were followed for 2nd, 4th week, 3rd, 6th, and 12 months, were assessed for functional ability by calculating the total active flexion (TAF) by adding the flexion of MP, PIP and DIP joints and total active extension deficit (TAED), whereas the total active motion (TAM) was calculated by subtracting the TAED from TAF. The distance from fingertip to distal palmer crease in maximal flexion (palm to pulp distance) and were compared with normal

Figure-2: (a) Palmaris Longus graft is being taken using tendon stripper. (b) Palmaris longus graft. (c) Palmaris Longus Graft tied to distal end of catheter. (d) Graft pulled through the new pseudo-sheath made by previously inserted catheter. (e) Graft being attached distally. (f) Graft being attached proximally. (g) Post operative klienert splint

Table: Results according to the Buck - Gramcko score.

	Buck - Gramcko score (fingers)
Excellent	13
Good	05
Satisfactory	03
Poor	01

hand. The functional outcome was classified according to Buck - Gramcko rating (Table).

Results

Out of 22 digits of 21 patients, twenty patients had one finger involvement while one patient had involvement of two digits. There were 15 (71.42%) male and 06 (28.57 females. Amongst 22 digits, there were 15 (68.18%) right sided and 07 (31.82%) were left sided. There were 6 (27.27%) Boyes grades I digits,11 (50%) grades II and 5 (22.72%) grades III. Seven (31.81%) patients had middle finger injury, six (27.27%) had index finger, four (18.18%) had little finger and three (13.63%) patients had ring finger involved and a patient with both index finger and middle finger. Majority, 14 (66.66%) patients had clean lacerated injury, while seven (33.33%) had crush injury.

According to Buck-Gramcko scale, thirteen (59.09%) digits had excellent, five (22.72%) had good results while three (13.63%) had satisfactory result and one (4.54%) had poor result. Four (18.18%) digits had deep infection after stage I while one (4.54%) patient had infection after stage II.

The mean total active flexion was 2400, and the mean total active motion achieved was 2180. The mean total active extension deficit was 220. The pulp to the distal crease distance was 0 cm in 13 (59.1%) patients, 0.5 cm in five (22.72%) patients, 1 to 2 cm in three (13.63%) patients and more than 2 cm in only one (4.54%) finger.

Four (18.18%) patients developed infection after stage I and required removal of catheter and redo stage I after the infection was settled. None of patients developed any post-operative complication.

One (4.54%) patient had infection after stage II and had poor outcome which was managed by giving oral antibiotics and was offered revision surgery for further treatment but he refused.

Discussion

Acute flexor tendon injuries can be managed primarily by repairing the tendon with atraumatic technique along with passive physiotherapy of the finger to prevent adhesion and to achieve good results. Neglected tendon injuries in no man's land usually are complicated by adhesion formation and/or by tendon retraction at the site of injury. They end up with loss of active flexion and later developed contracture of the digit. These injuries are managed by one or two stage tendon reconstructive procedures. Literature reported[4] reconstruction with silicone rod (Dacron) and for the first time we used silicone Foleys catheter to reconstruct the pseudosheath in stage I, as silicone (Dacron) rod is very costly and not easily available. On the other hand, the silicone Foleys catheter is low cost and is widely available. In our study, 81.81% had excellent and good results comparing with Siguo Sun et al and Abdul Kadir et al[6,11] who had 84% and 75% excellent results and good results respectively. It showed that in terms of functional outcome there was no significant difference. Buck-Gramcko scale is very useful for evaluation of outcome of digit motion but this scale has the drawback that it cannot express the subjective condition of the patient at the end of procedure but explain functional outcome assessed by surgeon. In Wehbe et al[8] and in Abdul Kadir et al,[6] the mean TAM was 1760 and 1880 respectively compared with our study it was 2180 which is far better. Abdul Kadir et al[6] did pedicled graft by making a loop between the distal ends of FDS and FDP in stage I and later reflecting the FDS from its musculotendinous junction and we did free tendon graft instead of pedicled graft for reconstruction and our results are better than his reported data. There are chances of adhesion formation in pedicled graft by making a loop in the palm that may be the cause of better results in our study than Abdul Kadir's published study.

When we compared our surgical technique of using silicone catheter with other studies done by Wehbe et al,[8] and Abdul Kadir et al[6] the results are similar or better than those achieved by silicone (Dacron) rod. It showed that silicone catheter can be used for further assess it in large population

The pulley reconstruction/ preservation is very important in having excellent outcome. So the A2 and A4 pulleys should be preserved during tendon reconstruction. Pulley system is important to decrease the degree of flexion contracture and to prevent the bowstringing.[2,8] In our study the A2 and A4 pulleys were preserved we had fortunately no digit in which we reconstruct the pulley.

It has been recommended by Paneva-Holevich to start the active physiotherapy in the first week after surgery

and they were of the opinion that there is no increase in the rupture of the tendon in early active physiotherapy.[12] In our study we started early active extension and passive flexion on the 2nd post op day so it may suggest that controlled physiotherapy results in excellent results.

Conclusion

We concluded that two stage flexor tendon reconstruction procedure using silicone Foley's catheter yields excellent and good results with free tendon graft, cost effective and easily available.

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