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International Journal of Surgery Case Reports

journal homepage: www.casereports.com

Spiral oblique retinacular ligament reconstruction using lateral band technique to treat swan neck deformity due to chronic mallet finger: A case report

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ARTICLE INFO

Article history:

Received 16 February 2021

Received in revised form 20 March 2021

Accepted 20 March 2021

Available online 26 March 2021

Keywords:

Swan neck deformity

Chronic mallet finger

SORL

Lateral band

ABSTRACT

INTRODUCTION: Swan neck deformity (SND) is characterized by hyperextension of proximal interphalangeal (PIP) joint and extension lag of distal interphalangeal (DIP) joint with functional loss of finger and impairs of tight grip of the finger. SND often results from chronic mallet injury and requires surgical treatment. One of the procedure is spiral oblique retinaculum ligament (SORL) reconstruction. We reported good outcome of swan neck deformity due to chronic mallet finger cases treated with SORL reconstruction using lateral band technique.

CASE PRESENTATION: We presented 2 case of swan neck deformity due to chronic mallet finger. A 21-year-old male with deformity of the left index finger for 2 years with with extension lag 50° and -20° PIP joint hyperextension and A 18-year-female with deformity of right ring finger for 4 years with extension lag 40° and -20° PIP joint hyperextension. We performed SORL reconstruction using lateral band technique. Ten weeks after surgery, patient achieved good range of motion and stability of PIP and DIP joint was obtained.

DISCUSSION: SORL reconstruction in a finger with a chronic mallet deformity coordinates extension of PIP and DIP joints by a dynamic tenodesis effect. This concept improves stability of both DIP and PIP joints by linking the volar flexor sheath to the lateral aspect of the terminal tendon using lateral band, thereby providing a mechanism of for automatic DIP joint extension upon active PIP extension.

CONCLUSION: SORL reconstruction using lateral band technique may be a good choice for treating swan neck deformity.

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1. Introduction

Swan neck deformity (SND) is characterized by hyperextension of proximal interphalangeal (PIP) joint and extension lag or flexion of distal interphalangeal (DIP) joint [1,2]. Patients with SND has a limitation of the overall function of the finger. The patient suffers a considerable functional loss of finger and impairs of a tight grip of the finger around an object [2]. SND often results from chronic mallet injury [1]. If left untreated, mallet finger leads to an imbalance in the distribution of the extensor force between PIP and DIP joints [3]. PIP Joint hyperextension may result from laxity or disruption of the volar plate and increased tension of central slip and the lateral band because of elongation of the terminal tendon [2,4]. Extension lag is caused by elongation of extensor element followed by compensatory DIP flexion [1].

Chronic mallet finger with SND requires surgical treatment. Surgery is indicated if there is extensor lag of 40° or impaired function [3,5]. Numerous procedures have been described for correcting of SND including tenodesis, tendon application, Fowler central slip tenotomy, oblique retinacular ligament (SORL) reconstruction, and arthrodesis of the distal interphalangeal (DIP) joint as a last choice [2,5]. In case of SND with extensor lags greater than 45°, ORL reconstruction is recommended procedure [1,6].

Thomson et al. introduced the concept of spiral oblique retinaculum ligament (SORL) reconstruction. This technique is a dynamic tenodesis that improves the stability of PIP and DIP joint that provide a mechanism for automatic DIP joint extension while active PIP extension [2,7,8]. There are two variants of SORL reconstruction technique using either the lateral band or a free tendon graft. Both of two variants have a similar outcome. Lateral band technique has more advantage that we do not need the tendon graft from other part of the body and has rapid active postoperative rehabilitation [2,5]. As first described by Littler lateral band can use for ORL reconstruction to treat swan neck deformity [9,10]. We reported 2 cases with swan neck deformity due to chronic mallet finger case

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Fig. 1. Pre operative clinical presentation. A. First case, left index finger B. Second case, right ring finger.

treated with SORL reconstruction using lateral band technique. The patients had a satisfactory range of motion and achieved the stability of the finger. This paper has been written according to the SCARE 2020 criteria [11].

2. Case presentation

In this report, we presented two cases. The first case, a 21-year-old male, presented with deformity of left index finger for 2 years. The patient had previous history of his left index finger hit by a ball. There was pain and angulation in distal interphalangeal joint. The patient went to a traditional bone setter and got massage several times. The pain subsided but his finger remained crooked. Afterwards, the patient did not seek any medication. The patient was an university student and right-handed. There is no other comorbidities. Patient came to our center for further treatment

Physical examination demonstrated swan neck deformity of the left index finger with a DIP joint in flexion with extension lag 50° and -20° PIP joint hyperextension (Fig. 1). The range of motion of the PIP joint was -20 to 90° in active motion and -20 to 110° in passive motion. The range of motion of DIP joint is $50-80^\circ$ in active motion and $0-80^\circ$ in passive motion. We did hand x-ray that shows a flexion deformity and secondary degeneration in DIP joint of left index finger (Fig. 2).

The second case, a 18-year-old female, presented with deformity of right ring finger for 4 years. The patient had previous history of her right ring finger hit by a ball. After the injury, the finger became swollen and painful. After the injury, the patient did not seek any medication. Currently, she fell ashamed with her ring finger deformity and came to our center for further treatment. The

patient was a high school student and right-handed. There is no other comorbidities.

Physical examination demonstrated swan neck deformity of the right ring finger with a DIP joint in flexion with extension lag 40° and -20° PIP joint hyperextension (Fig. 1). The range of motion of the PIP joint was -20 to 90° in active motion and -20 to 110° in passive motion. The range of motion of DIP joint is $40-80^\circ$ in active motion and $0-80^\circ$ in passive motion. Right hand x-ray showed that flexion deformity in DIP joint of left index finger, there was no sign of joint degeneration (Fig. 2).

We diagnosed both of these patients with swan neck deformity due to chronic mallet finger. We performed same procedure by SORL reconstruction using lateral band technique and immobilization using K-wire of PIP joint for 2 weeks in flexion 20° and DIP joint for 6 weeks in neutral position. The procedure performed by Hand and Microsurgery Consultant of Orthopaedic Surgeon in our national general hospital.

2.1. Surgical procedure

We did an incision on the dorsum of the left index finger to expose the extensor apparatus. Intraoperative we evaluated ulnar lateral band was intact. The lateral band was released and proximal part of the ulnar lateral band was incised and then lateral band was rerouted through a deep volar passage that was tunnelled and retrieved proximally on the contralateral side [10]. The proximal end of the lateral band was anchor sutured to the radial side of proximal phalanx. As introduced by Kleinman and Peterson, K-wire was inserted to get immobilization of PIP joint in 20° flexion and DIP joint in neutral position [1,8] (Figs. 3 and 4).



Fig. 2. Pre operative X-Ray. A. First case, there is flexion deformity and secondary degeneration of DIP joint of left index finger. A. Second case, there is flexion deformity of right ring finger without joint degeneration.

2.2. Follow up and outcomes

Two weeks after surgery the wound healed and there was no sign of infection, K-wire was retracted until PIP joint was free and allowed active mobilization of PIP joint. Six weeks after the surgery, the K-wire was removed and the patient began to mobilized PIP and DIP joint actively. Four weeks later we evaluated the result of surgery. In both case, we found that good range of motion and stability of PIP and DIP joint was obtained. First case, there was active motion 10–80° of the DIP joint and 0–90° of PIP joint. Second case, there was active motion 10–70° of DIP joint and 0–100° of PIP joint (Fig. 5).

3. Discussion

The function of the ORL in the normal finger is controversial. However, despite controversy over its function in the normal finger, ORL reconstruction of an ORL in a digit with a chronic mallet deformity coordinates extension of PIP and DIP joints by a dynamic tenodesis effect [1]. The concept of ORL reconstruction is a dynamic tenodesis that improves stability of both the DIP and PIP joints by linking the volar flexor sheath to the lateral aspect of the terminal tendon, thereby providing a mechanism of for automatic DIP joint extension upon active PIP extension [2]. Littler [3] firstly described the use of an intact lateral band for ORL reconstruction, by which the

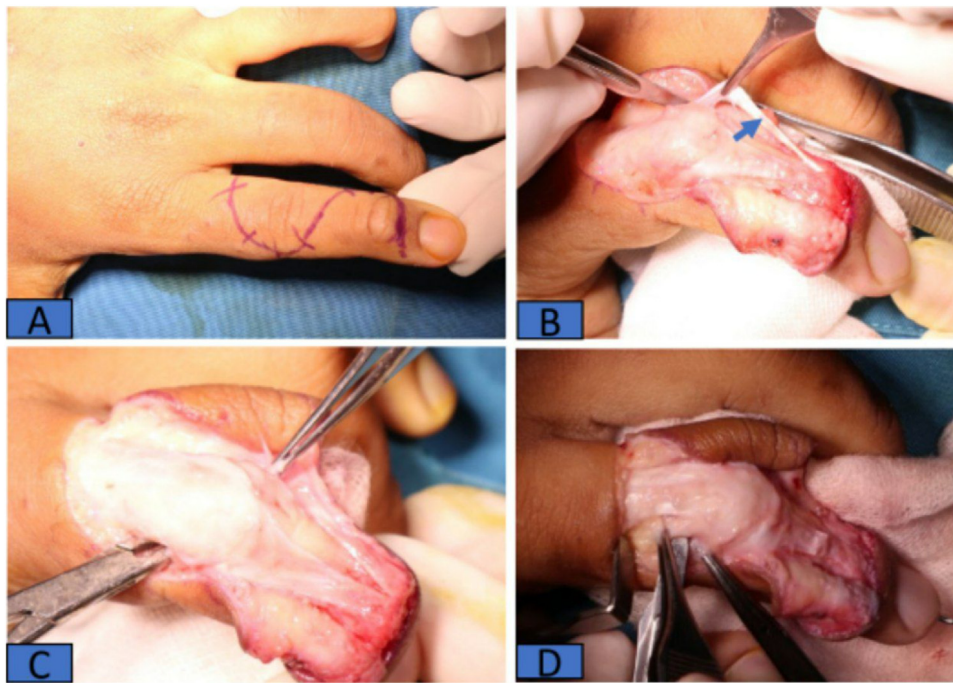


Fig. 3. Intraoperative picture of lateral band technique. A. "S" design and incision in dorsal of the left index finger. B. Ulnar lateral band (arrow) expose and incised in proximal part. C. Tunneling of volar side to reroute of the lateral band to contralateral. D. Anchor suturing of ulnar lateral band to radial side of proximal phalang.



Fig. 4. Post operative x-ray. We did insertion of K-wire to immobilized PIP joint in 20° of flexion and DIP joint in neutral position.

band is released proximally, rerouted to the axis of the PIP rotation on the volar side, and secured to the flexor tendon sheath [10]. Subsequently, Thompson et al. [4] described a similar reconstruction using a free tendon of small caliber as a spiral oblique retinacular ligament (SORL) for the treatment of mallet and swan-neck deformities. Their technique is appealing but technically demanding. To date, only a few studies described the outcome of SORL reconstruction [2].

Anatomically, the ORL originates from the volar middle third of the proximal phalanx and the PIP flexor sheath, passes dor-

sally deep to the transverse retinacular ligament, and joins the lateral aspects of the terminal extensor tendon distally. In 1967, Littler [3] described a reconstruction by which the lateral band was used to exploit the mechanism of ORL. This procedure is able to restore the balance of extensor forces across both interphalangeal joints but required an intact, healthy terminal tendon at the extensor insertion site. Thus, its application was limited to those mallet deformities where the lateral band was found to be robust at the time of intraoperative inspection [5].



Fig. 5. Ten weeks postoperatively. A. First case. B. Second case. Both of case obtain good position of the finger and good range of motion of PIP and DIP joint.

We performed SORL reconstruction using lateral band technique and immobilization using K-wire of PIP joint for 2 weeks in flexion 20° and DIP joint for 6 weeks in neutral position. Ten weeks postoperatively, the patient had good range of motion of both PIP and DIP joints of the left index finger. No complications were observed in our case. In Littler's initial study [3], the freed por-

tion of the lateral band was fixed to the fibrous tendon sheath, and in the subsequent publication, pull-out tenodesis was described in both the proximal and distal phalanges, using either hemoclips or buttons. Active motion exercises were commenced at 3 weeks in both of these studies [4,6]. In a 1984 publication an ORL reconstruction, Kleinman and Petersen [1] reported the fixation of the

distal end by a pull-out button anchor and the proximal end to the fibrous rim of fibroosseous canal, with K-wire fixation of the DIP joint. Again, the rehabilitation was delayed until three weeks after the operation.

3.1. Conclusions

In conclusion, SORL reconstruction using lateral band technique is a choice to treat swan neck deformity. We support the continued use of this technique. Further studies are required to investigate the safety and efficacy of this technique.

Declaration of Competing Interest

The authors report no declarations of interest.

Sources of funding

None declared.

Ethical approval

Ethical approval has been received from Cipto Mangunkusumo Hospital, Jakarta, Indonesia.

Consent

Written informed consent was obtained from the patient's parents for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Wildan Latief: performing the procedure, study concept, data collection.

Nesta Enggra: data collection, writing the paper, provided revisions to scientific content of manuscript.

Registration of research studies

Not applicable.

Guarantor

Wildan Latief.

Provenance and peer review

Not commissioned, externally peer-reviewed.

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