

## Evaluation of the Results of Neglected Achilles -Tendon Injury Reconstruction by Baker's Procedure

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### Abstract

**Introduction:** Neglected Achilles tendon injuries pose a challenge in achieving optimal outcomes. This study aims to investigate the surgical management of such cases, considering unique demographic and etiological factors prevalent in our population.

**Methods:** This prospective interventional study was conducted at the Department of Orthopaedic Surgery, Dhaka Medical College & Hospital, the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), and selected private hospitals in Dhaka, Bangladesh, from January 1, 2012, to May 31, 2013 with a total of 42 patients with neglected Achilles tendon injuries underwent surgical intervention. Demographic data, injury characteristics, and postoperative outcomes were analyzed. Surgical techniques included scar tissue resection, end-to-end repair and reconstruction by Baker's procedure and tailored approaches based on individual cases.

**Result:** The cohort exhibited diverse age distribution, with notable male predominance (71.4%). Occupationally, housewives/housemaids (28.57%) and manual laborers (21.42%) were frequently affected. Left-sided injuries were prominent (57%), predominantly caused by sharp-metal injuries (57.14%) and toilet-pan accidents (35.71%). Palpable gaps were present in 71% of cases. Postoperatively, pain reduction was significant (85%), and mild stiffness affected 28.57% of patients. Calf muscle weakness was absent in 64.29%, mild in 28.57%, and moderate in 7.14%. Footwear restrictions were minimal (7.14%), and active range of motion improved in 64.29%. Outcomes were predominantly excellent (64.29%), with 21.42% good and 14.29% fair results. Complications included wound/stitch infections (21.43%), effectively managed with intervention.

**Conclusion:** End-to-end reconstruction by Baker's procedure yielded favorable outcomes in neglected cases of ruptured Achilles tendon, addressing the unique demographic and etiological factors prevalent in our population. Our findings emphasize the importance of individualized interventions in optimizing results.

**Keywords:** Neglected Achilles Tendon Injuries, Reconstruction, Surgical Intervention, Baker's procedure.

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### I. INTRODUCTION

In the realm of Greek mythology and immortalized by Homer's Iliad, Achilles, the valiant Greek hero of the Trojan War, met his tragic demise due to a vulnerability in his heel – a crucial tendon later named after him, the Achilles tendon (1). This tendon, formed by the aponeurosis of the gastrocnemius and soleus muscles, stands as the strongest and thickest in the human body, emphasizing its paramount functional importance. Notably, its dysfunction leads to a significant loss of plantar flexion strength, impairing essential activities such as running, standing on tiptoes, engaging in sports, and even climbing stairs (2). Achilles tendon injuries are frequent, often resulting from forced dorsi-flexion, direct trauma, overuse in intense sports, and even direct steroid injections (3). Regrettably, some individuals delay seeking medical attention, with studies indicating that initial evaluations miss Achilles tendon ruptures in approximately 25% of cases (2,4,5). These neglected ruptures, defined by presentations occurring more than four weeks post-injury, present unique challenges. Scar tissue may form during this interval, allowing for potential healing without surgery. However, despite this healing, the contracture of the triceps surae complex can result in compromised plantar-flexion power, reduced ankle stability, and an impaired gait pattern (6). The debate surrounding the optimal treatment for Achilles

tendon ruptures persists, especially in cases of delayed presentations. While early ruptures may be subject to discussions between surgical and conservative approaches, the consensus leans towards surgical intervention for late presentations. Surgical techniques include fascial advancement, tendon transfers, graft augmentation, and ankle fusion, each with its merits and considerations (2). Additionally, allograft and xenograft materials, such as porcine intestinal xenograft and dermal matrix allograft, have been explored for augmenting tendon repair (7,8). Surgical success hinges on the restoration of the gastrocnemius-soleus complex's function and strength by recreating the optimal length-tension relationship. End-to-end repair, particularly if feasible without extensive scar tissue, is considered ideal for maximizing isokinetic strength (6). Within this landscape of Achilles tendon reconstruction, Baker's Procedure, introduced by LD Baker in 1956, stands out. This technique involves gastrocnemius aponeurosis advancement in a 'Tongue-in-groove' or inverted 'U' fashion, proving effective for Achilles tendon reconstruction (1,9). Baker's Procedure offers several advantages, such as bridging the defect without sacrificing significant lower limb tendons and avoiding additional surgical sites. Its technical simplicity makes it an attractive option, particularly when compared to alternatives like V-Y advancement flaps, with nearly 50% more achievable length (9). The procedure's uniqueness lies in its ability to address challenges associated with delayed Achilles tendon repair, including the increasing gap between tendon ends, shortening of the gastro-soleus complex, viability of overlying skin, ankle joint stiffness, and prolonged immobilization. In this series, the goal is to establish a comprehensive and logical approach to address the complexities of delayed Tendo-Achilles repair within the context of current healthcare service situations. By delving into the intricacies of the Achilles tendon, exploring surgical interventions, and highlighting the merits of Baker's Procedure, this research aims to contribute valuable insights to the field of orthopedics and enhance the understanding of effective strategies for managing neglected Achilles tendon injuries.

## II. METHODS

The prospective interventional study was conducted at the Department of Orthopaedic Surgery, Dhaka Medical College & Hospital, the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), and selected private hospitals in Dhaka, Bangladesh, from January 1, 2012, to May 31, 2013. The study included patients with signs of old Tendo-Achilles rupture, aged 18 to 60 years, seeking treatment for difficulties in activities such as running and climbing stairs. A total of 42 participants were purposively sampled based on availability, strictly adhering to inclusion and exclusion criteria. Inclusion criteria encompassed ruptures persisting for more than 4 weeks with no prior treatment, while exclusion criteria involved cases below 18 or above 60 years, recent ruptures, associated muscle or nerve injuries, fractures in the affected limb, and other health conditions. Neglected Achilles tendon injury was operationally defined as a presentation delay exceeding 4 weeks after injury, untreated or inadequately treated. The study's primary focus was to assess the functional outcomes of neglected rupture Achilles tendon reconstruction using Baker's Procedure. After surgery, limb was kept elevated for 24-48 hours and all patients were immobilized by a long leg ant. Plaster slab with knee in 30° - 40° degree flexion and ankle in 20° -25° degree of plantar flexion for two weeks. Isometric quadriceps exercise and toe movements was advised. After two weeks, all stitches were removed and a long leg full plaster was applied with knee in 30-degree flexion and ankle in gravity equinus for another 4 weeks. After 6 weeks, long leg cast was removed and a short leg full plaster was applied with ankle in neutral /plantigrade position for another 4 weeks. Patients were advised for quadriceps exercises and non-weight bearing walking with crutches. At 10th weeks, plaster was removed and patients was advised for walk with 3-5 cm heel-lift for another 4 wks and reduction of heel-lift at a rate of 1 cm/wk. Physiotherapy such as quadriceps strengthening exercises, knee and ankle movement was advised to continue. The chosen assessment tool was the Juhana Leppilahti modified scoring system (10).

## III. RESULTS

**Table 1:** Distribution of baseline characteristics (N=42)

Variables	Frequency	Percentage
<b>Age</b>		
≤ 20	6	14.29%
21-30	15	35.71%
31-40	15	35.71%
≥ 40	6	14.29%
Mean±SD	30.7 ± 9.19	
<b>Gender</b>		
Male	30	71.43%
Female	12	28.57%

Occupation		
Farmer	9	21.43%
Day-laborer	9	21.43%
House-wife/house-maid	12	28.57%
Student	6	14.29%
Athlete	3	7.14%
Businessman	3	7.14%

The age distribution indicates a varied representation, with 14.29% of participants aged 20 or below, 35.71% in the 21-30 age group, another 35.71% in the 31-40 age range, and 14.29% aged 40 or above. The mean age of the participants was 30.7 years, with a standard deviation of 9.19. Gender distribution shows a predominance of males, constituting 71.43% of the sample, while females make up 28.57%. Regarding occupation, the participants encompass a diverse range, with 21.43% identified as farmers and day laborers each, 28.57% as housewives or housemaids, 14.29% as students, and 7.14% each as athletes and businessmen.

**Table 2:** Distribution of participants by interval between injury and operation (N=42)

Interval	Frequency	Percentage
≤ 6 weeks	15	35.71%
6-10 weeks	24	57.14%
≥ 10 weeks	3	7.14%
Mean±SD	7.5 ±1.99	

The majority of participants, comprising 35.71%, underwent the operation within 6 weeks of the injury. A significant portion, accounting for 57.14%, had the operation performed between 6 and 10 weeks after the injury. A smaller percentage, 7.14%, experienced a delay in operation, occurring at or beyond 10 weeks post-injury. The mean interval between injury and operation was calculated to be 7.5 weeks, with a standard deviation of 1.99.

**Table 3:** Distribution of participants by injury related characteristics (N=42)

Variables	Frequency	Percentage
<b>Side of Injury</b>		
Right Achilles tendon	24	57.14%
Left Achilles tendon	18	42.86%
<b>Cause of Injury</b>		
Sharp-metal injury	24	57.14%
Toilet-pan injury	15	35.71%
Sports injury	3	7.14%
<b>Presence of Palpable Gap</b>		
Yes	30	71.43%
No	12	28.57%

In terms of the side of injury, a majority of participants, constituting 57.14%, experienced Achilles tendon injuries on the right side, while 42.86% had injuries on the left side. The cause of injury varied, with 57.14% attributed to sharp-metal injuries, 35.71% to toilet-pan injuries, and a smaller percentage of 7.14% associated with sports injuries. When assessing the presence of a palpable gap, a substantial 71.43% of participants exhibited this characteristic, while 28.57% did not.

**Table 4:** Assessment of patients after surgery: (According to Juhana Leppilahti Modified Scoring Scale;1998) (N=42)

Variables	Frequency	Percentage
<b>Pain</b>		
No pain	36	85.71%
Mild pain	6	14.29%
<b>Stiffness of affected ankle</b>		
No stiffness	30	71.43%

Mild stiffness	12	28.57%
<b>Calf- muscle weakness</b>		
None	27	64.29%
Mild weakness	12	28.57%
Moderate weakness	3	7.14%
<b>Footwear restrictions</b>		
None	39	92.86%
Mild	3	7.14%
<b>Active Range of Motion</b>		
Normal ( $\leq 5^\circ$ )	27	64.29%
Mildly limited ( $6^\circ - 10^\circ$ )	15	35.71%

The table presents the assessment of patients after surgery based on the Juhana Leppilahti Modified Scoring Scale (1998) (N=42). In terms of pain, a substantial 85.71% reported no pain during the post-surgery era, while 14.29% experienced mild pain. The evaluation of ankle stiffness revealed that the majority, 71.43%, reported no stiffness, while 28.57% reported mild stiffness. Regarding calf muscle weakness, 64.29% reported no weakness, 28.57% reported mild weakness, and 7.14% reported moderate weakness. In terms of footwear restrictions, a significant 92.86% reported none, while 7.14% reported mild restrictions. Assessing the active range of motion, the majority, 64.29%, exhibited normal range ( $\leq 5^\circ$ ), while 35.71% showed mildly limited motion ( $6^\circ - 10^\circ$ ).

**Table 5:** Distribution of participants by incidence of complications (N=42)

Complications	Frequency	Percentage
No Complications	33	78.57%
Stitch/Wound Infections	9	21.43%

A significant proportion, 78.57%, reported no complications following the surgical intervention. However, 21.43% of participants experienced complications, predominantly in the form of stitch or wound infections.

**Table 6:** Distribution of participants by final outcome (N=42)

Final Outcome	Frequency	Percentage
Excellent	27	64.29%
Good	9	21.43%
Fair	6	14.29%

The majority of participants, constituting 64.29%, achieved an excellent final outcome. A notable 21.43% reported a good outcome, while 14.29% reported a fair outcome.

#### IV. DISCUSSION

The surgical intervention for neglected Achilles tendon injuries aims to restore the optimal length-tension relationship of the gastrocnemius-soleus complex, with end-to-end repair considered ideal when direct apposition is achievable after scar tissue resection (6). In our study, including 42 patients, we observed a diverse age distribution, with 14.28% below 20 years, 35.7% between 21-30 years, 35.7% between 31-40 years, and 14.28% above 40 years, aligning with findings from multiple other studies (1,11-14). Male predominance (71.4%) in our cohort corresponds with the literature, reflecting the higher incidence of Achilles tendon injuries in males engaged in sports (1). Occupation-wise, housewives/housemaids accounted for 28.57%, day laborers and farmers 21.42% each, students 14.29%, and the remaining 15% included athletes and businessmen (13). Left-sided Achilles tendon injuries prevailed (57%), akin to observations by Maffuli and Nistor (1,15). Regarding the etiology, sharp-metal injuries constituted 57.14%, toilet-pan injuries 35.71%, and sports injuries 7.14%, deviating from Western trends, highlighting the prevalence of toilet-pan injuries in our context (16,17). Palpable gaps were present in 71% of cases, aligning with Safwat et al.'s findings (14). Postoperatively, notable pain reduction (85%) mirrored Ibrahim et al.'s outcomes (17). Mild stiffness affected 28.57%, consistent with reports by Nistor et al's and Lee et al's studies (6,15). In terms of calf muscle weakness, 64.29% showed none, 28.57% mild, and 7.14% moderate weakness, which was a similar distribution to multiple other studies (1,12,14,18). Footwear restrictions were minimal (7.14%), paralleling the findings of multiple studies (15,19). Improvements in active range of motion (ROM) were observed, with 64.29% regaining full ROM, similar to Mahmud et al. and Lee et al. (6,16). Outcomes were predominantly excellent (64.29%), with 21.42% good and 14.29% fair results, aligning with the findings of few other studies (6,20). Complications included wound/stitch

infections (21.43%), managed effectively. No re-ruptures or sural nerve injuries occurred during the follow-up period, consistent with Tay et al.'s study (21). Our study provides insights into neglected Achilles tendon injuries, emphasizing the need for tailored surgical approaches, especially in the context of unique injury patterns prevalent in our population.

#### *Limitations of The Study*

The study was conducted in a few numbers of hospitals with a small sample size. So, the results may not represent the whole community.

### V. CONCLUSION

In conclusion, our study focused on neglected Achilles tendon injuries reconstructed by Baker's procedure, shedding light on the diverse demographic and injury characteristics within our population. The favorable outcomes, with a majority achieving excellent results, underscore the efficacy of this surgical intervention. Noteworthy improvements in pain, stiffness, muscle weakness, and range of motion were observed, emphasizing the procedure's positive impact on functional recovery. The low incidence of complications, specifically re-rupture and nerve injuries, further supports the safety and effectiveness of Baker's procedure in addressing neglected Achilles tendon injuries. Our findings contribute to the existing body of knowledge, providing valuable insights for clinicians managing similar cases and highlighting the importance of context-specific considerations in the surgical management of Achilles tendon injuries.

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**Conflict of interest:** None declared

**Ethical approval:** The study was approved by the Institutional Ethics Committee

### REFERENCES

- [1]. Maffulli N. Current Concepts Review - Rupture Of The Achilles Tendon\*. *Jbjs*. 1999 Jul;81(7):1019.
- [2]. Padanilam Tg. Chronic Achilles Tendon Ruptures. *Foot And Ankle Clinics*. 2009 Dec 1;14(4):711–28.
- [3]. Shamrock Ag, Dreyer Ma, Varacallo M. Achilles Tendon Rupture. In: Statpearls [Internet]. Treasure Island (FL): Statpearls Publishing; 2023 [Cited 2024 Jan 6]. Available From: [Http://Www.Ncbi.Nlm.Nih.Gov/Books/Nbk430844/](http://www.ncbi.nlm.nih.gov/books/nbk430844/)
- [4]. Scheller Ad, Kasser Jr, Quigley Tb. Tendon Injuries About The Ankle. *Orthopedic Clinics Of North America*. 1980 Oct 1;11(4):801–11.
- [5]. Nestorson J, Movin T, Möller M, Karlsson J. Function After Achilles Tendon Rupture In The Elderly: 25 Patients Older Than 65 Years Followed For 3 Years. *Acta Orthopaedica Scandinavica*. 2000 Mar 1;71:64–8.
- [6]. Lee J, Schubert Jm. Surgical Treatment Of The Neglected Achilles Tendon Rupture. *Achilles Tendon Rijeka: Intech*. 2012;115–41.
- [7]. Fridman, Dpm, Aacfas R. Repair Of Nelgected Achilles Tendon Rupture With Monofilament Polypropylene Mesh: A Case Study Of 12 Patients. *Faoj* [Internet]. 2008 May 1 [Cited 2024 Jan 6];1(5). Available From: [Http://Faoj.Wordpress.Com/2008/05/01/Repair-Of-Nelgected-Achilles-Tendon-Rupture-With-Monofilament-Polypropylene-Mesh-A-Case-Study-Of-12-Patients/](http://Faoj.Wordpress.Com/2008/05/01/Repair-Of-Nelgected-Achilles-Tendon-Rupture-With-Monofilament-Polypropylene-Mesh-A-Case-Study-Of-12-Patients/)
- [8]. Doral Mn, Bozkurt M, Turhan E, Dönmez G, Demirel M, Kaya D, Et Al. Achilles Tendon Rupture: Physiotherapy And Endoscopy-Assisted Surgical Treatment Of A Common Sports Injury. *Open Access Journal Of Sports Medicine*. 2010 Dec 13;1:233–40.
- [9]. Oommen Ms Orth At, Poonnoose Ms Orth Pm, Padhy Ms Orth D, Korula Ms Orth Rj. Management Of Open Chronic Tendo Achilles Injuries: A Case Report. *Faoj* [Internet]. 2010 Jan [Cited 2024 Jan 6]; Available From: [Http://Www.Faoj.Org/2010/01/01/Management-Of-Open-Chronic-Tendo-Achilles-Injuries-A-Case-Report/](http://www.faoj.org/2010/01/01/Management-Of-Open-Chronic-Tendo-Achilles-Injuries-A-Case-Report/)
- [10]. Leppilähti J, Forsman K, Puranen J, Orava S. Outcome And Prognostic Factors Of Achilles Rupture Repair Using A New Scoring Method. *Clinical Orthopaedics And Related Research*. 1998;346:152–61.
- [11]. Pintore E, Barra V, Pintore R, Maffulli N. Peroneus Brevis Tendon Transfer In Neglected Tears Of The Achilles Tendon. *Journal Of Trauma And Acute Care Surgery*. 2001 Jan;50(1):71.
- [12]. Kakiuchi M. A Combined Open And Percutaneous Technique For Repair Of Tendo Achillis. Comparison With Open Repair. *The Journal Of Bone & Joint Surgery British Volume*. 1995 Jan 1;77-B(1):60–3.
- [13]. Kosaka T, Yamamoto K. Long-Term Effects Of Chronic Achilles Tendon Rupture Treatment, Using Reconstruction With Peroneus Brevis Transfer, On Sports Activities.
- [14]. Mohamad Safwat Mostafa S, Mohamad Heshmat Ak, Osama Abdolla D. Surgical Repair Of Neglected Achilles Tendon Ruptures. 1998;135–42.
- [15]. Nistor L. Surgical And Non-Surgical Treatment Of Achilles Tendon Rupture. A Prospective Randomized Study. *Jbjs*. 1981 Mar;63(3):394.
- [16]. Wagdy-Mahmoud S, Megahed Ah, El-Sheshtawy Oe. Repair Of The Calcaneal Tendon. An Improved Technique. *The Journal Of Bone & Joint Surgery British Volume*. 1992 Jan 1;74-B(1):114–7.
- [17]. Razik Ibrahim Sa. Surgical Treatment Of Chronic Achilles Tendon Rupture. *The Journal Of Foot And Ankle Surgery*. 2009 May 1;48(3):340–6.
- [18]. Inglis Ae, Scott Wn, Sculco Tp, Patterson Ah. Ruptures Of The Tendo Achillis. An Objective Assessment Of Surgical And Non-Surgical Treatment. *Jbjs*. 1976 Oct;58(7):990.
- [19]. Demirel M, Turhan E, Dereboy F, Yazar T. Augmented Repair Of Acute Tendo Achilles Ruptures With Gastrosoleus Turn Down Fap. *Ijoo*. 2011 Feb 1;45(1):45–52.
- [20]. Mann Ra, Holmes Gbj, Seale Ks, Collins Dn. Chronic Rupture Of The Achilles Tendon: A New Technique Of Repair. *Jbjs*. 1991 Feb;73(2):214.
- [21]. Tay D, Lin Ha, Tan Bs, Chong Kw, Singh Rikhraj I. Chronic Achilles Tendon Rupture Treated With Two Turndown Flaps And Flexor Hallucis Longus Augmentation—Two-Year Clinical Outcome. *Annals Academy Of Medicine Singapore*. 2010;39(1):58.