COMPLICATION-FREE ACHILLES TENDON REPAIR

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ABSTRACT

Fifty-one patients with subcutaneous rupture of the tendo calcanei Achillis were consecutively operated on with simple end-to-end suture using Bunnell's technique. The operation was performed under local anaesthesia. All patients were seen at follow-up four months after the operation. The complication rate was low compared to the ones reported in the current literature.

It is concluded that operative treatment of Achilles tendon rupture performed under local anaesthesia is safe, economical and acceptable to patients.

INTRODUCTION

Rupture of the Achilles tendon is a common athletic injury. The rupture is often unilateral and is most frequently seen in middle-aged sportsmen (Barfred, 1973). During the past 40 years the treatment of choice has been operative reconstruction, which in most cases permitted the athlete to return to his sport. However to avoid delayed healing, necrosis of the skin, adhesions, infections and anaesthetic complications, conservative treatment has been recommended and debated in recent years (Gillies and Chalmers, 1970; Lea and Smith, 1972; Stein and Leukens, 1976; Nistor, 1976; Persson and Wredmark, 1979). The high rate of re-rupture and healing with residual elongation of the tendon following conservative treatment has been stressed in several publications (Jacobs, Martens et al, 1978; Nistor, 1976; Edna, 1980), therefore most authors still consider operative treatment to be superior to conservative treatment. Simple end-to-end suturing performed under general anaesthesia and using a tourniquet has proved to be as successful as other operative reconstructions (Arndt, 1976; Brade, 1977; Heim and Heim, 1977; Jessing and Hansen, 1975).

To avoid anaesthetic problems (including that of needing the service of an anaesthetist), to simplify the operative intervention and to minimise the risk of post-operative complications, surgical repair has been performed by simple end-to-end suture under local anaesthesia at the Orthopaedic Surgery Hospital in the city of Sorø, Denmark.

TABLE I

Sport activities at the time of accident in 48 patients with rupture of the Achilles tendon

	Women	Men	Ratio Men:Women	Per cent
Handball	2	16	18	37.5
Badminton	3	14	17	35.5
Football	0	6	6	12.5
Gymnastics	2	3	5	10.4
Trampoline	0	1	1	2.1
Jogging	0	1	1	2.1
Total	7	41	48	100.0

MATERIAL

In the period between October 1979 and May 1981, fifty-one patients with subcutaneous rupture of the Achilles tendon were operated upon under local anaes-

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thetia. There were 41 men and 10 women, aged between 20 and 79 years, average 36 years. In 29, the rupture occurred on the left side, and in 22, on the right. Participation in sport (Table I) accounted for 48 of them (95%) and the remaining three sustained their injury during every-day activities. Among those sustaining the rupture during sporting activity, 44 had been in activity for at least half an hour before the injury occurred, and in four it took place within five minutes of commencing a training session (Fig. 1). Prior to the acute rupture nine patients (18%) suffered pain in the calf of the leg in which the rupture later occurred. Two of them had been treated with local steroid injections at another centre one and four months respectively before the rupture.

Fig. 1: Duration of training session when sustaining Achilles tendon rupture in 51 patients.

The rupture was diagnosed by the usual clinical examination; all had swelling, tenderness and a palpable defect at the site of the lesion. None were able to stand on their toes, and all reacted positively to the Thompson test (Thompson and Doherty, 1961) (Fig. 2). The Thompson test is specific for Achilles tendon rupture and is performed with the patient kneeling on a table or chair with the feet extending over the chair. Compression of the calf by squeezing will result in plantar-flexion of the foot if the Achilles tendon mechanism is intact. If it has been ruptured, no motion will be transmitted to the foot and the foot will stay idle as the compression or squeezing of the calf continues.

METHOD AND RESULTS

Operation was carried out within four days from the time of rupture in 49 patients, and the remaining two, after three and four weeks respectively. The operation was performed under local anaesthetic with Carbocain®. We regarded this as the most suitable agent as its duration of action coincided with the usual duration of the operation, and gave effective anaesthesia if injected at the time the pre-operative theatre preparation was

Fig. 2: Thompson test shows that the Achilles tendon is intact (without rupture).

commended. The anaesthetic mixture contained adrenalin, but the addition of heparin was not considered necessary. The amount used varied between 5 and 15 ml, averaging 12 ml.

There is no evidence to suggest that the anaesthetic mixture stimulated healing, led to the release of chymin, or had any beneficial or deleterious effect upon vascularity, except for the temporary vasoconstriction due to the adrenalin. The small quantity used, 12 ml, would not cause any lasting effects, as more than ten times this amount would have to be given before necrosis of the wound edges would be likely to occur (Fig. 3).

Fig. 3: The anaesthesiological procedure. Through the proximal injection 5 to 10 ml Carbocain® (Mepivacain) is given. Distally 3 to 5 ml are injected.

The operation was performed without a tourniquet through a four to nine cm long longitudinal dorsal incision over the site of the rupture. The paratenon was handled very carefully, and divided in the midline by a longitudinal incision. The ruptured tendon was thus exposed, and the frayed ends, sometimes in contact with each other, and sometimes separated by as much as six cm were approximated and sutured end-to-end by Bunnell's method (Bunnell, 1964) with No. 1 silk (Fig. 4). The paratenon and subcuticular tissues were closed in layers with absorbable suture, and the skin closed with nylon. The operations were carried out by the usual team of surgeons with varying experience. One nurse assisted the surgeon, while another looked after and talked to the patient, who was placed in the prone position during the operation.

Fig. 4: Site of Achilles tendon rupture in cm proximal to the insertion on calcaneus in 51 patients.

The operative procedure was not complicated by the usual problems met with in using a general anaesthetic, and there were no difficulties in approximating the cut ends of the tendon. No significant bleeding occurred during the operation. Pre-operative blood samples were not considered necessary as routine. No pain was felt by 48 patients, who were comfortable throughout the operation; three experienced slight pain when the tendon was pulled together, but did not require further analgesia. A below-knee plaster was applied for six weeks with the ankle in moderate plantar flexion. The skin sutures were removed after two weeks through a window cut in the plaster. After removal of the plaster active non-weight bearing exercises were started for two weeks. Walking was then allowed.

All 51 patients were examined 4 months after operation, and no cases of skin necrosis, wound infections, delayed wound healing or disturbances of sensa-

tion were observed. One patient developed a suture granuloma which was removed operatively 6 months after the repair of the tendon. Re-rupture occurred in one patient after 3½ months.

All patients sustaining the rupture during sports were participating actively in their sport 5 months after the rupture. Six months after the surgical repair of the ruptured Achilles tendon all but two felt that they were performing at the same level as before the rupture. One man playing handball had intermittent pain in the tendon after training, and did not feel secure while jumping. He stopped playing handball after 8 months. Another man playing football had difficulties when he kicked the ball. He also had intermittent pain in the tendon after training, was treated by physiotherapy and heel raise and felt no inconvenience after 8 months.

In an objective evaluation of the relative plantar flexion power (Jacobs, Martens et al, 1978) a mean of 91% (85-100) was regained 4 months after the rupture. Normal plantar flexion was noted in all patients, slight decreased dorsiflexion was observed in 8, and minor fixation of the scar was found in 6 patients. In all the gait was close to normal 4 months after the rupture. The results of the follow-up four months after the operation are shown in Table II.

All patients were asked if they would prefer local anaesthesia to general anaesthesia; all answers were positive.

DISCUSSION

Among sportsmen having a rupture of the Achilles tendon, it is of the utmost importance to have sufficient treatment which will re-establish the strength of the triceps surae muscles and gives a quick return to sport at the same level as before injury, and the treatment should give the lowest risk of sequelae especially that of re-rupture.

The relative plantar flexion power has in several publications been used as a measure of the efficiency of the treatment. In these materials the relative plantar flexion power was 62 to 90 per cent after conservative treatment, and 75 to 95 per cent after surgical repair (Borgi et al, 1978; Cetti et al, 1981; Inglis et al, 1976; Jacobs et al, 1978; Lagergren and Lindholm, 1959; Lea and Smith, 1972; Nistor, 1976). In the present study 91 per cent of the relative plantar flexion power was regained 4 months after the operation.

Multiple aetiologies for tendon ruptures have been indicated. The significance of pre-existing tendon disease, subtle degenerative changes occurring with increasing age, repeated trauma and circulatory depletion to the tendon is still debatable. In 1971 Barfred demonstrated Achilles tendon rupture to occur in healthy wild rats when rapid elongation is combined with tetanic stimulation.

TABLE II

Movements and leg circumference of injured leg compared with opposite uninjured (control) limbs

Case No.	Age	Sex	Injured Leg	Movements P.F. Control	D.F. Control	P.F. Power Affected Unaffected	%	Circumference (cms) Control	Gait	Fixation of the scar
1	52									
1	52	M	L	40/40	20/20	45/53	85	33½/36	S.L.	no
2	26	M	L	45/45	25/25	47/50	94	37 /38½	N	no
3	26	F	R	40/40	10/25	43/50	86	41½/43	N	yes
4	41	M	R	40/35	20/20	40/45	89	35 /37	N	no
5	47	M	R	35/35	10/25	46/50	92	34 /37	N	yes
6	39	F	R	35/35	20/20	37/42	88	40 /41½	N	no
7	20	M	R	50/50	25/25	53/55	96	40 /41½	N	no
8	36	M	R	35/35	15/20	43/47	92	34½/35½	S.L.	yes
9	32	M	R	35/35	10/25	45/53	85	36 /38½	S.L.	no
10	26	M	R	35/35	20/20	48/52	92	39½/40½	N	no
11	32	M	L	40/40	20/20	53/58	91	38 /39½	N	no
12	28	M	L	35/35	20/25	45/51	88	39½/41	N	no
13	32	M	R	40/40	20/20	50/56	89	38½/41	N	no
14	26	M	L	35/35	20/20	45/50	90	39½/41	N	no
15	32	M	R	35/40	15/20	43/50	86	38 /40½	N	no
16	24	M	R	35/35	10/25	43/50	86	36 /40	S.L.	yes
17	35	M	R	40/40	20/20	48/52	92	38 /38½	N	no
18	31	M	R	40/40	20/20	53/55	96	39½/41	N	no
19	36	M	R	35/30	15/10	42/46	91	35½/36	N	no
20	43	M	L	35/35	15/15	44/52	85	36 /40	N	no
21	35	M	L	35/35	20/20	48/54	89	37½/40	N	no
22	39	M	L	40/45	10/20	46/53	89	38½/42	N	no
23	35	M	L	40/40	20/20	43/50	86	37 /38	N	no
24	22	F	R	35/40	20/25	47/50	94	40 /41½	N	no
25	28	M	L	40/35	10/25	53/57	93	39 /39	N	no
26	38	M	L	40/40	20/20	51/53	96	39 /40	N	no
27	35	F	L	35/35	15/10	47/49	96	37 /37½	N	no
28	34	F	R	50/45	20/20	45/53	85	34½/37	N	no
29	42	M	L	35/35	20/20	53/57	93	38 /38	N	yes
30	42	M	L	35/35	25/25	51/51	100	40 /40½	N	no
31	26	M	R	40/40	20/25	48/52	92	39 /39	N	no
32	29	F	R	40/35	20/20	38/42	90	34 /36	N	no
33	53	M	L	30/35	15/15	51/53	96	40 /40	N	no
34	21	M	R	35/40	10/25	53/58	91	39 /39½	S.L.	no
35	23	F	L	40/40	20/20	50/56	89	38 /41	N	no
36	38	M	L	40/40	15/15	47/53	89	40 /41	N	no
37	37	M	L	35/40	15/20	48/54	89	39½/40	N	no
38	33	M	L	40/40	25/25	45/50	90	40 /39½	N	no
39	30	F	L	40/40	25/25	37/42	88	37 /38	N	yes
40	43	M	L	35/40	20/20	45/50	90	39 /39	N	no
41	27	M	L	40/35	20/20	47/50	94	40 /40½	N	no
42	29	M	R	35/35	25/20	56/56	100	42 /42	N	no
43	47	M	L	35/35	20/20	48/52	92	40½/40	N	no
44	30	M	R	40/40	20/20	52/52	100	40 /40	N	no
45	31	M	L	50/50	15/20	53/55	96	38 /38	N	no
46	34	M	L	40/40	25/25	45/53	86	38 /39½	N	no
47	35	M	L	35/40	10/25	48/52	92	38 /40½	N	no
48	79	F	L	30/35	20/20	37/42	88	35½/37	S.L.	no
49	22	M	L	40/40	15/20	53/55	96	41 /41	N	no
50	20	M	L	50/45	25/25	42/46	91	38 /38½	N	no
51	72	F	R	35/35	15/15	38/42	90	40 /40	S.L.	no

Abbreviations

P.F.:	Plantar flexion	M.:	Male
D.F.:	Dorsal flexion	F.:	Female
S.L.:	Slight limp	L.:	Left
N.:	Normal	R.:	Right

The tendon ruptures in a poorly vascularised area, approximately 2 to 5 cm proximal to the insertion on calcaneus. In the present study the site of rupture was 0 to 7 cm proximal to the insertion, but only three were outside the blood poor area 2 to 5 cm above the calcaneus. Of these two were in patients with premorbid steroid injections close to the insertion. They ruptured the tendon within 1 cm from the calcaneus. The details and considerations of these steroid induced ruptures have been dealt with in another report (Cetti and Christensen, 1982). The last patient ruptured the tendon 7 cm proximal to calcaneus. In my opinion there is no doubt that the most essential aetiological factor in rupture of the Achilles tendon is an ischaemic insult which correlated to the physical efforts leads to the rupture. With deference to this aetiological thinking and striving for re-establishing anatomical continuity, normal plantar flexion power and normal ankle mobility, the decisions were made concerning not using a tourniquet during the operation, not inducing lack in the control of the legs pre- and post-operatively by performing the operation under some kind of general anaesthesia, and not making an operative procedure which enlarge the affected area as seen in several procedures using the fascia of the triceps surae muscles, etc.

In 1981 Cetti et al in a preliminary study of ruptured Achilles tendons in twenty-two patients treated surgically with simple end-to-end suture using the technique described in 1964 by Bunnell. The use of local anaesthetic emphasised that the type of anaesthesia had no influence on the operative procedure. He concluded that rupture of the Achilles tendon can be adequately treated by operation under local anaesthesia.

The frequency of re-rupture following conservative treatment is 10 to 35 per cent compared with less than 6 per cent after surgical repair (Cetti et al, 1981; Dekker and Bender, 1977; Gillies and Chalmers, 1970; Inglis et al, 1976; Jessing and Hansen, 1975; Lea and Smith, 1972; Lildholdt and Munch-Jørgensen, 1976; Nistor, 1976; Persson and Wredmark, 1979; Stein and Luekens, 1976).

In 1968 and 1972 Lea and Smith tabulated the complications from several series in open surgical repair of ruptured Achilles tendons. Major complications (re-rupture, infection, skin slough, fistulas, thrombosis) occurred once in every 5.8 cases (17%). Minor complications (adherent scar, sural nerve injury) occurred once in

every 4.2 cases (24%). In the present study major complications (1 re-rupture, 1 suture granuloma) were noted in 4 per cent. Minor complications (6 patients with minor adherence of the scar) were seen in 12 per cent. None of the patients with minor complications had any inconvenience at all.

Thus it can be emphasised that the treatment of ruptured Achilles tendons still is operative and that the treatment of choice is surgical repair performed under local anaesthesia.

The use of local anaesthesia is simple, economical and requires only a minimum of equipment. Compared with general anaesthesia less pre-operative preparations are needed. Problems in obtaining acute anaesthesiological assistance are avoided and an obvious rationalisation of the staff needed for turning the patient and similar procedures is achieved. The patient is exposed to less strain by avoiding premedication, intubation and potential anaesthesiological complications, and less post-operative observation is required. Additionally it is a simple way of solving the problems concerning operative contraindications. The dose of local anaesthetic used in the present study has been sufficient. Complete analgesia is achieved if the operation is performed in plantar flexion avoiding direct pulling of the tendon.

So, surgical repair of ruptured Achilles tendons can be performed under local anaesthesia without complicating the operative procedure. Not only is it more economical but it minimises the number of staff required and is more satisfactory for the patient. Furthermore it diminishes the risk of pre- and post-operative complications and gives a quick return to normal gait.

The absence of skin necrosis was most gratifying, as most surgeons report about 20% incidence. With our technique we avoided the use of plastic or fascia lata grafts which might interfere with the blood supply by causing "strangulation" when the wound was closed. The use of local anaesthetic allowed maintenance of protective reflexes against pressure; the absence of a tourniquet avoided endangering blood supply through vascular spasm, and the moderate degree of plantar flexion avoided stretching the skin and underlying tissues as much as in the extreme plantar flexion used by others.

REFERENCES

- Arndt, K. H., 1976 "Achilles tendon rupture and sport". *Zentralbl.Chir.* 101: 360-64.
- Barfred, T., 1973 "Achilles tendon rupture". *Acta Orthop.Scand.Suppl.* 152.

- Borgi, R., Oberlin, P. and Faure, C., 1978 "La rupture du tendon d'Achille, traitement orthopedique ou traitement chirurgical?" *Acta Orthop.Belg.* 44: 560-66.
- Brade, A., 1977 "Verletzungen der Achillessehne und operative therapie: Plantarisdurchflechtung oder adaptationsnaht". *Unfallheilk.* 80: 73-76.
- Bunnell, S., 1964. *Surgery of the hand.* Lippincott, London.
- Cetti, R. and Christensen, S.-E., 1982 "Achilles tendon rupture after local steroid injection". *Ugeskr.Laeg.* 144: 1392.
- Cetti, R., Christensen, S.-E. and Reuther, K., 1981 "Ruptured Achilles tendons treated surgically under local anaesthesia". *Acta Orthop.Scand.* 52: 675-77.
- Dekker, M. and Bender, J., 1977 "Results of surgical treatment of rupture of the Achilles tendon with use of the plantaris tendon". *Arch.Chir.Nederl.* 39-46.
- Edna, T. H., 1980 "Non-operative treatment of Achilles tendon ruptures". *Acta Orthop.Scand.* 51: 991-93.
- Gillies, H. and Chalmers, J. J., 1970 "The management of fresh ruptures of the tendo Achillis". *J.Bone Jt.Surg.* 52: 337-43.
- Heim, U. and Heim, C., 1977 "Die subkutane Achillessehneruptur". *Helv.Chir.Acta* 44: 581-90.
- Inglis, A. E., Scott, N., Sculco, T. P. and Patterson, A. H., 1976 "Ruptures of the tendo Achillis". *J.Bone Jt.Surg.* 58A: 990-93.
- Jacobs, D., Martens, M., Van Audekercke, R., Mulier, J. C. and Mulier, F. R., 1978 "Comparison of conservative and operative treatment of Achilles tendon rupture". *Am.J.Sports Med.* 6: 107-11.
- Jessing, P. and Hansen, I., 1975 "Surgical treatment of 102 tendo Achillis ruptures — Suture or tenoplasty?" *Acta Chir.Scand.* 141: 370-77.
- Lagergren, C. and Lindholm, A., 1959 "Vascular distribution in the Achilles tendon". *Acta Chir.Scand.* 116: 491-95.
- Lea, R. B. and Smith, L. I., 1968 "Rupture of the Achilles tendon, non-surgical treatment". *Clin.Orthop.* 60: 115-118.
- Lea, R. B. and Smith, L. I., 1972 "Non-surgical treatment of tendo Achillis rupture". *J.Bone Jt.Surg.* 54A: 1398-1407.
- Lindholt, T. and Munch-Jørgensen, T., 1976 "Conservative treatment of Achilles tendon rupture". *Acta Orthop.Scand.* 47: 454-58.
- Nistor, L., 1976 "Conservative treatment of fresh subcutaneous rupture of the Achilles tendon". *Acta Orthop.Scand.* 47: 459-62.
- Persson, A. and Wredmark, T., 1979 "The treatment of total ruptures of the Achilles tendon by plaster immobilisation". *International Orthop. (SICOT)* 3: 149-52.
- Stein, S. R. and Leukens, C. A., 1976 "Closed treatment of Achilles tendon ruptures". *Orthop.Clin.North Am.* 7: 241-46.
- Thompson, T. C. and Doherty, J. H., 1962 "Spontaneous rupture of tendon of Achilles: a new clinical diagnostic test". *J.Trauma* 2: 126-29.