TOTAL ANKLE ARTHROPLASTY : TOMODENSITOMETRIC EVOLUTION OF THE PERIPROSTHETIC CYSTS AT OF 4-YEARS APART AND ASSESSMENT OF THE SURVIVAL CURVES AT 13-YEARS FOLLOW-UP



Docteur Julien Lucas y Hernandez, CHU Pellegrin - Bordeaux - FRANCE





I. A step more physiological **TAR or Fusion** ?

Piriou, P., et al. (2008). "Ankle replacement versus arthrodesis: a comparative gait analysis study." Foot Ankle Int 29(1): 3-9.

2. Protection of adjacent joints



3. Preservation of range of motion

Third Generation TAR

5-year survivorship, in igodolsitu TAR : 70% à 98%

significant increase in the AOFAS score (AOFAS, Kofoed, Foot Function Index)

Clin	Orthop Relat Res (2010) 468:199-208	
DOI	10.1007/s11999-009-0987-3	

CLINICAL RESEARCH

How Successful are Current Ankle Replacements?

A Systematic Review of the Literature

Nikolaos Gougoulias MD, F " Khanna MD, Nicola Maffulli MD, PhD

Received: 20 November @ The Association of I

Results of Total Ankle Arthroplasty Mark E. Easky, MD, Samuel B. Adams Jr., MD, W. Chad Hembree, MD, and Janes K. DeOrio, MD Abstract Total to arthrodesis f ► Most published reports related to total ankle arthroplasy have a fair to poorquality level of evidence. the outcome of Most puoses neares neares and part of a state of a state of and possibly knows and possibly how and possibly in use? We studies repo We include equar para reaser and possible influences influence total ank On the basis of the current literature, survivorship of total ankle arthroplasty implants, varies from 70% to 39% at three to six years and from 80% to 35% at eight to a minin ogy S Welve years Several investigators have agreed that in the evolution of total and/e anthopias/, some outgatory reoperation include retief of osseval or solution include retief of osse Thirt on Several investigators have algored that, in the evolution of total ankle anticipates, encoded of the metal implants is anticipated; examples of reoperation include relief of easient of algorithm to stability of the foot and ankle, bone gaining for cost of easier of easier and easier and easier of easier and easier of easier and easier of easier and easier of easier of easier and easier of easier and easier of easier and easier of easier and easier of easier easier of easier easier and easier of easier easier and easier and easier ST Window envolution in the medial implication is not to extension in the medial implication is a state interview of the medial implication in the medial implication is a state interview of the medial implication in the medial implication is a state interview of the medial implication in the medial implication is a state interview of the medial implication in the medial implication is a state interview of the medial implication in the medial implication is a state interview of the medial implication in the medial implication in the medial implication is a state interview of the medial implication in the m S A successful return to low/mpact, recreational sporting activities is possible after total ankle antiropiast. End-stage anide arthritis is as debilitating as end-stage hip ar-thritis', ver total ioint arthroplagy has not displaced arthropedia End-stage ankle arthritis is as debilitating as end-stage hip at the stage ankle arthritis is as debilitating as end-stage hip at the stage ankle arthritis. Recent prospective controlled trials and meta-analyses have suggested that, for end-stage for end-stage ankle arthritis. Recent prospective controlled ankle arthritis modern total ankle arthrophasty affords equiv-alent pain relief and perhans better function than ankle arthropic and and perhans better function than ankle arthropic arthropic arthropic and and and and and and arthropic arthropi ankle arthrötis modern total ankle arthroplasty aförds avur alon pain total ankle arthroplasty aförds avur throdesis- in this article, we review the current than ankle av ankle arthroplasty and factors that may affect the intermetion available of the state of the current the state of total throdesiss. In this article, we review the current results of these results. and/c arthrophesity and factors that may affect the interpretation varship-o vorship of 70%: in all other studies reviewed, the implant Mean efficacy outcomes and patient satisfication with the uniformly suggest improvement from property earlier follow. hese results. Mean efficacy outcomes and patient satisfaction with the if of total and/e arthroplasty at intermediate-term follow. vorship** vorship of 20 %; in all other studies net al ** noted a survi survivorship was >39% for three to twelve vars. Some studies twelve vars. Some studies Pesuh of total ankle arthroplasty at intermediate term fallow up uniformly suggest improvement intermediate term fallow Pain subscores and functional outcomes are equal to and mark total terms outcomes are equal to and mark vorship of 70%; in all other studies reviewed, the implant survivorship was >>% for three to twelve rears. Some studies include longer follow-up of the same nations or implants from ip unifomly suggest inprovement from propositive values is a subscores and functional outcomes are equal to and may exceed those of ank is anthrodesis. With few excentions, implant survivorship was >29% for three to twelve year. Some studies include langer follow-up of the same partients or implants studies previous a tudies or represent a different analysis of the same Fain subscores and functional outcomes are equal to and man exceed those of ankle arthrodesis. With few exciptions, implan aurivioration has been reported to range from 70% to 98% at include longer follow-up of the same patients or implants from Previous statics or represent a different stadys of the same Datients success · · · The majority of the implants contributing to contributing to exceed those of ankle arthrodesis. With few exceptions, implied anyivor ship has been reported to innee from 20% to 25% at eight to here is a stand from 80% to 25% at eight to here is a stand to be aurivorship has been reported to sange from 70% to 98% at three to six years and from 80% to 98% at eight to heelve 94% at on the basis of the 2240 total andle arthrophysics from nulture Patients^{41,61,6}. The majority of the implants contributing of the radiographic appearance of some of three to six years and from 80% to 95% at eight to twelve reas on the basis of the 2240 total ankie arthroplastic from multiple autics with adequate follow-up to determine implant surviv on the basis of the 2240 total ankle arthrophanies from multiple studies with adequate follow-up to determine implant multiple implant survi. thee survivoship curves had a satisfactory radiographic appearance. However, the radiographic appearance of some of the netal implants also included in these survivorship and vas has successed impending failure with loosening and the or represent a other on analyse or the same is the majority of the implants contributing to patho curves had a satisfactory radiographic and the metal implants also included in these survivorship and, subsidence. For select implants, revision surgery may allow for the retention of the oriental includers, Repeat slow

subsidence. For select implants, revision surgery may allow for the retention of the original metal implants, Repeat allow kery in total ankle arthroplasty does not imply a failure of allow a failure of

for the retention of the original metal implants. Repeat sur-gery in total ankle arthroplasty does not implants. Repeat sur-total ankle arthroplasty, as some repeat surgery is for relieving gery in total ankle arthroplasty does not inply a failure of total ankle arthroplasty as some repeat surgery is for failure of inningement, inproving alignment, bone-grating cysts and total ankle arthroplasty, as some repeat surgery is for relieving inpingement, inproving algoment, bone-grafting cysts, and or exchanging the polyethylene component to prolong implant inpingement, inproving alignment, bone-grating cysts, and or exchanging the polyedyione component to prolong inplan survival. Confounding variables, such as a prolonge inplan.

<u>Easley, M.E., et al., Results of total ankle arthroplasty. J Bone Joint Surg Am, 2011</u>

Account of the or man of the o And the second s / survival. Confounding variables, such as a prolonged less of surgeons implanting total and le registic ments <u>Gougoulias, N., A. Khan</u>na, and N. Maffulli, How successful are current ankle replacements?? a Relat Res, 2010. 468(1): p. 199-208. .

ture. Clin Orthop







SALTO™

SERIOUS CONCERN

Mid term large periprosthetic cysts in every TAR

Lucas, Y. H. J., et al. (2014). "AKILE total ankle arthroplasty: **Clinical and CT scan analysis of** periprosthetic cysts." Orthop **Traumatol Surg Res.**

Mean F-up : 6,7 years \pm 3 months

- Functional results
- Survival curve
- Glazebrook complication classification

Survival at 5 years : 72,3%

The functional benefits of mobile-bearing total ankle replacement (TAR) implants in the medium-term are significant [1,2]. But periprosthetic osteolysis and cysts in the medium and long-term 2. Material and methods are a source of concern and temper the excellent short-term results [3]. In some studies, the rate of radiolucent lines and cysts has 2.1. Study design reached 75%, with large cysts compromising implant stability [4-6]. The primary objective of the current study was to analyze the radiographic results in a cohort of existing AKILETM TAR by looking for the presence of bone cysts and evaluating their size on CT scans. The Corresponding author, *B*-moti address: julien.lucas@chu-bordeaux.fr (J. Lucas y Hernandez).
 http://dx.doi.org/10.1016/j.otsr.2014.09.019 1877-0568/@ 2014 Elsevier Masson SAS. All rights reserved. 68 patients

1 Introduction



Orthopaedics & Traumatology: Surgery & Research 100 (2014) 907-915



J. Lucas y Hernandez ^{a,*}, O. Laffenêtre^a, E. Toullec^b, V. Darcel^c, D. Chauveaux^a

² Or thopédio-traumatologie Dr. Chauveaux, groupe hospitalier Pellegrin, place Amétie Raba-Léon, 33000 Bardeaux, France ^b Polyciniane de Bardema Tondu, 151, rue du Tondu, 33000 Bardema, France * HIA Robert-Picqué, 351, route de Toulouse, 33882 Villenave-d'Ornon, Prance



large periprosthetic cysts (> 400 mm²) in the medium-term is a source of concern Objective: The primary objective of this study was to detect any large periprosthetic cysts in a cohort of

AKILETM patients using radiographs and CT scans, and then to compare these findings to published ones, Material and methods: A total of 127 TAR procedures were performed between June 1995 and January 2012. We retrospectively reviewed 68 cases with the newest AKILETM implant design that had a minimum follow-up of 36 months. The average follow-up was 81 ± 33 months; eight patients were lost to follow-up. The outcomes consisted of analyzing radiographs (A/P and lateral weight bearing views, Meary view and lateral views of flexion/extension) and helical CT scans, performing clinical evaluations (range of motion AOFAS score, Foot Function Index, pain levels) and determining the survivorship of TAR implants.

sults: TAR survival at 5 years was 79% for in situ implants and 62% for revision-free implants. The AOFAS score improved from 33.7 ± 14.7 to 77.1 ± 15.1 (out of 100) and the pain sub-score was 30.2 ± 9.7 (out of 40) at the last follow-up. The average ankle range of motion was 32.3° ± 12.7° on the radiographs. CT scan revealed Type A cysts (< 200 mm²) under the talar implant in 52% of cases and in the tibia in 50% of cases; these cysts were smaller than 100 mm² in 80% of cases and had no effect on the implants. No periprosthetic cysts larger than 400 mm² in size were identified.

Discussion: The medium-term functional results and survivorship are comparable to those reported for other TAR designs. The incidence of cysts was low overall and there were no large-diameter cysts, which should improve long-term survival. The implant's design and materials likely played a role in preserving the periprosthetic bone stock. The AKILETM TAR has distinctive features related to the low rate of large periprosthetic cysts in the medium-term. Level of evidence: IV (retrospective case series)

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secondary objective was to determine the clinical results and compare them to published results. Only patients who had undergone TAR with the newest AKILE[™] implant design were reviewed.

This was a retrospective study of the AKILETM TAR procedures performed by the surgeon designers (DC and OL, Bordeaux University Hospital) between June 1995 and January 2012. The inclusion criteria consisted of primary, post-traumatic or inflammatory ankle arthritis as graded by Morrey and Wiedemann [7], which had failed conservative treatment and had at least 10° range of motion with no equinus deformity. Exclusion criteria consisted of greater than 10°

Glazebrook MA, Arsenault K, Dunbar M. Evidence-based classification of complications in total ankle arthroplasty. Foot Ankle Int 2009;30:945-9.



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<u>Registre NZ 202 cas et 45 non déclarés</u>

=22%

	Before	après
AOFAS	33,7	77,1

Mean F-up : 6,7 years ± 3 months



RADIOGRAPHS AND CT-SCAN ANALYSIS

Rodriguez protocol

Mean F-up : 6,7 years ± 3 months

A (0-200 mm²), B (200-400 mm²), C (more than 400 mm²)

93 % of cysts finded were Type A (<200 mm²)

80 % of cysts A were lower than100 mm²

Rodriguez, D., et al., Medium term follow-up of the AES ankle prosthesis: High rate of asymptomatic osteolysis. Foot Ankle Surg, 2010. 16(2): p. 54-60.



0,4

0 0

REGISTER	5 y	10 Y						
SWEDISH 2007	78%	62%	STAR AES					
NEW ZEALAND 2007	86%	?	No X-ray / lost 20%	0				
NORVEGIAN 2007	89%	76%						
FINLAND 2010	83%	?	No X-ray AES/star					
Our 2014 study 5			y survival					
change of at lea one metal component	ast		75,4%	13	14	15	16	17

MATERIALS & METHODS

2012 cohort : 68 patients / 42 Ct scan

 59 ± 11 years

Mean F-up : 13 years \pm 6 months

Classic F-up and new CT-scan



A (0-200 mm²), B (200-400 mm²), C (more than 400 mm²)



- Carbioceram[™] (DLC) stainless steel Implant
- bone-implant interface : alumina
- a dual-curvature PE insert and
- a spherical tibial component



DISCUSSION



Stability of the cysts in number

- Small caliber : type A
- Volume of type A decrease
- 22% of cysts increase slightly

no preoperative CT

phenomena of complex reworking of the subchondral bone

- over-estimation by osteoarhritis
- New protocol with preoperative scann

DISCUSSION

subtalar arthrodesis would allow a partial revascularization of the talus

No talar cyst was found in patients who underwent subtalar arthrodesis



Kodama N, Takemura Y, Shioji S, Imai S. Arthrodesis of the ankle using an anterior sliding tibial graft for osteoarthritis secondary to osteonecrosis of the talus: A comparison of vascularised non-vascularised grafts. *Bone Jt J.* 2016;98-B(3):359-364. doi:10.1302/0301-620X.98B3.36154.

DISCUSSION Survival curve is a statistic curve and need F-up to be reliable

5-year survival

change of at least one metal component

Our study 82.7% with a mean F-up = 13 years ± 6 months

				Year	Number	5y survival	10y survival
	STAR	Anderson	Sweden	2003	51	70,0	-
Mean F-up = 3.8 y	STAR	Wood	UK	2008	200	93,3	80,3
Mean F-up = 9.1 y	STAR	Mann	USA	2011	84	96,0	90,0
	STAR	Brunner	Switzerland	2013	77	-	70,7
Mean E μ n = 6.2 y	Hintegra	Barg	Switzerland	2013	684	94,0	84,0
Mean F-up = 6.3 y							
	STAR	Kerkhoff	Netherlands	2016	134	-	78

DISCUSSION Survival curve is a statistic curve and need F-up to be reliable



Third generation mobile bearing.

- Carbioceram[™] (DLC) stainless steel Implant
- bone-implant interface : alumina
- a dual-curvature PE insert and
- a spherical tibial component

- Chrome Cobalt implant
- hydroxyapatite and porous titanium
- flat tibial component





HYPOTHESIS

Cysts development

- PE wear debris
- Chrome / cobalt particles
- Titanium particles
- design



- Tribology stainless steel / Carbioceram Friction coefficient
 - bone-implant interface : alumina

CONCLUSION

Cysts are less frequent and smaller Cysts stay stable 4 years apart

5-year survival 82.7%

ROM and AOFAS stable 4 years apart



STRENGH

Over time tomodensitometric study F-up of 13y Tribology ?
Design ?
Both ?