# 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

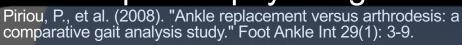


Docteur Julien Lucas y Hernandez, CHU Pellegrin - Bordeaux - FRANCE





# INTRODUCTION TAR or Fusion ? 1. A step more physiological





2. Protection of adjacent joints



3. Preservation of range of motion

#### Third Generation TAR

5-year survivorship, in situ 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 Vhanna MD, Nicola Maffulli MD, PhD Results of Total Ankle Arthroplasty Received: 20 November @ The Association of F Mark E Easky, MD, Samuel B, Adams Jr., MD, W. Chad Hembree, MD, and James K. DeOrio, MD Abstract Total to arthrodesis f Most published reports related to total ankle anthropiasty have a fair to poorquality level of evidence. the outcome of Comparative studies with a fair to good quality level of evidence states that total ankle arthrodesis.

And possibly improved function compared with ankle arthrodesis. in use? We studies repo We includ On the basis of the curent literature, sunworship of total ankle arthroplasty imploves to SSK to SSK at three to SIK years and from 80% to 95% at eight to total ank On the basis of the current literature, survivorship of total ankle arthroplasty implants, when measured as the of the sax years and from 80% to 95% at eight to a minin ogy S Several five signatures are several five and the metal implants is anticipated; examples of resperation include reflect of assecution assecution include reflect of assecution assecution assecution include reflect of assecution assec Thirt Several fivestigators have agriced that, in the evolution of total ankle arthroplasty, some obligatory respectively of the foot and ankle, bone gailing for Ossic leskins. Without shreet as the without state of the foot and ankle, bone grattly of osseous or some state of the foot and ankle, bone grattly of osseous or some state of osseous or A Successful return to low/impact, recreational sporting activities is possible after total ariske anthropiasty. End-stage ankle arthritis is as debilitating as end-stage hip ar-thritis'. Vet total ioint arthronology has not displaced arthrodesis End-stage ankle arthritis is as debilitating as end-stage hip arthritis. Yet oral point arthroplasy has not displaced arthritis. Recent prospective controlled and meta-analysis have suggested that, for end-stage for end-stage ankle arthritis.

Itals and meta-shalpses have suggested that for end-stage ankle arthritis.

All pain pelies and perhaps better function than ankle arthritis and perhaps better function than ankle arthritis and perhaps better function than ankle are and ankle are arthritises. ankle arthritis modern total ankle arthroplasty affords equivalent throclasty and perhaps better function than ankle arthroplasty affords equivalent than ankle arthroplasty and factors that may affect the internation throdesis in this article, we review the current results of total of these results.

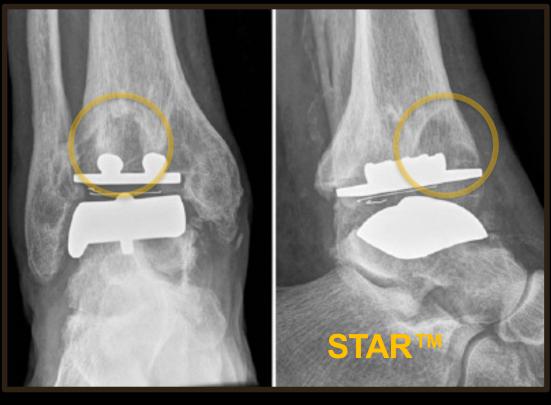
The property and factors that may affect the interpretation vorship on Only one study, Anderson et al a noted a survi-Mean efficacy outcomes and patient satisfaction with the uniformly suggest improvement from preoperative values. hese results.

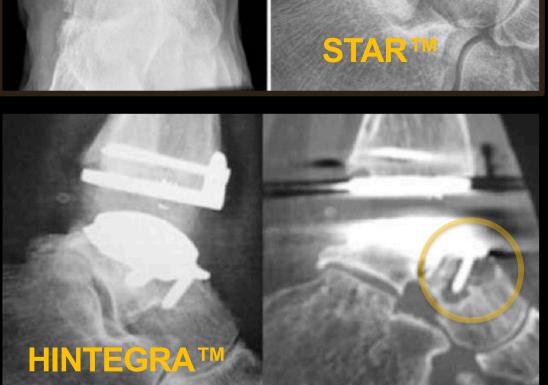
Mean efficacy outcomes and patient satisfaction with the arthroplasty at intermediate-term follow. Forship of Only one study, Anderson et al \*\*
survivorship was 270% in all other studies reviewed, the implant
twelve years, Some studies up uniformly suggest improvement from preoperative followand functional outcomes are equal to and may Vorship of 70%; in all other studies seriewed, the implant of the same patients or implant or implant of the same patients or implant from up uniformly suggest improvement from preoperative values.

Street those of ankle arthrodesis. With few exceptions, implinit SUPPROTESHIP Was >79% for three to twelve years. Some studies or represent a different analysis of the same of the same partients or implants from the same of the same Eain subscores and functional outcomes are equal to and may the few exceptions, implant to sage from 70% to sage at include longer follow-up of the same patients or implants from single states of the same patients or implants from the involvant contributing to exceed those of ankle arthrodesis. With few exceptions implant to the few to 98% at eight to have the 98% to 98% at eight to have the years. aurivorship has been reported to range from 70% to 98% at thombastics from multiple three to six years and from 80% to 95% at eight to the 2240 total and earthrophastics from multiple to determine implant survi. on the basis of the 2240 total ankle arthophastics from multiple

determine implant survi. these survivoship curves had a satisfactory fadiographic appearance thowever, the radiographic appearance of some of impending failure with loosening and the or represent a otherent analyse or the same anisotropy and curves had a satisfactory rationability and companies and companies contributing to Description of any or note of the subset of the metal implants also included in these survivorship anal-subsidence. For select implants, revision surgery may allow for the retention of the original metal implants, revision surgery may allow the original metal implants. Rocat sursubsidence. For select implants, revision surgery may allow arthroplasty does not implants. Repeat sursubstance of the substance of the substa for the retention of the original netal implants. Repeat surtotal ankle arthroplasty, as some repeat surgery is for relieving Sery in total ankle arthroplasty does not imply a failure of grafting Costs, as some repeat surgery is for relieving Costs, and total ankle arthroplasty, as some repeat surgery is for relieving or exchanging the polyethylene component to prolong limited to prolong limited. impingement, improving alignment, bone-grating costs, and survival. Confounding variables, such as a Drolong implant ing curve for surgeons implanting total and the replications of th

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

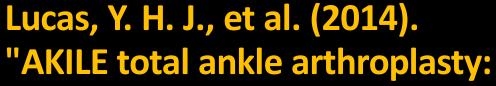






#### **SERIOUS CONCERN**

Mid term large periprosthetic cysts in every TAR



Clinical and CT scan analysis of periprosthetic cysts." Orthop

**Traumatol Surg Res.** 

Mean F-up : 6,7 years ± 3 months

- Functional results
- Survival curve
- Glazebrook complication classification

Survival at 5 years: 72,3%



ScienceDirect





#### AKILETM total ankle arthroplasty: Clinical and CT scan analysis of periprosthetic cysts



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ARSTRACT

Introduction: Despite good clinical results following total ankle replacement (TAR), the development of 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 AKILE<sup>TM</sup> implant design that had a minimum follow-up of 36 months. The average follow-up was  $81 \pm 33$  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.

esults: TAR survival at 5 years was 79% for in situ implants and 62% for revision-free implants. The AOFAS score improved from  $33.7 \pm 14.7$  to  $77.1 \pm 15.1$  (out of 100) and the pain sub-score was  $30.2 \pm 9.7$  (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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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 are a source of concern and temper the excellent short-term results [3]. In some studies, the rate of radiolucent lines and cysts has 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

http://dx.doi.org/10.1016/j.otsr.2014.09.019 1877-0568/6 2014 Elsevier Masson SAS. All rights reserved. secondary objective was to determine the clinical results and compare them to published results. Only patients who had undergone TAR with the newest AKILETM implant design were reviewed.

#### 2. Material and method:

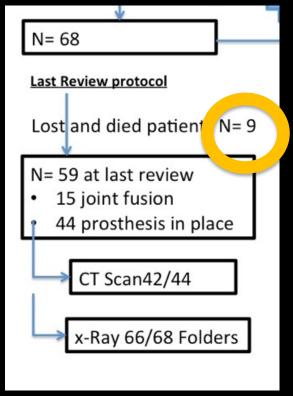
#### 2.1. Study design

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°

68 patients

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

Corresponding author.
 E-moli oddres: julien.lucas@chu-bordeaux.fr (J. Lucas y Hernandez.).



#### **2012 STUDY**

=13,2%

- Schenk, K., et al. (20) spective study of a cementless generation to 200 (osthesis." Foot Ankle Int 32(8): 200 (63.
- Registre NZ 202 cas et 45 non déclarés

=22%

	Before	après
AOFAS	33,7	77,1

Mean F-up : 6,7 years ± 3 months



# RADIOGRAPHS AND CT-SCAN ANALYSIS

#### Rodriguez protocol



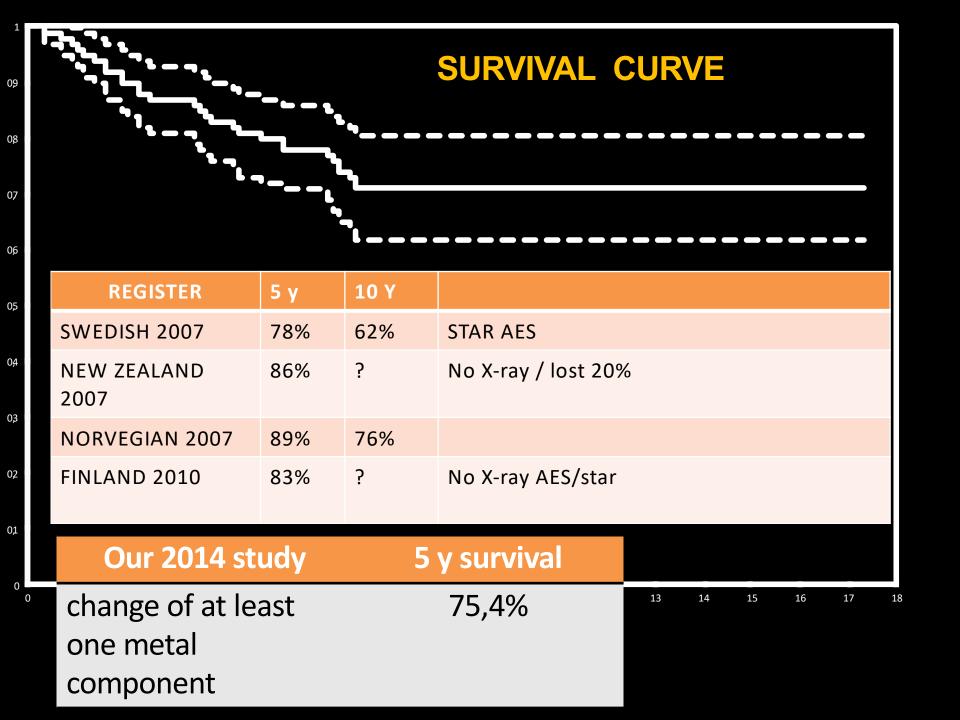
Mean F-up : 6,7 years ± 3 months



A (0-200 mm<sup>2</sup>), B (200-400 mm<sup>2</sup>), C (more than 400 mm<sup>2</sup>)

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

80 % of cysts A were lower than 100 mm<sup>2</sup>



# MATERIALS & METHODS

2012 cohort: 68 patients / 42 Ct scan

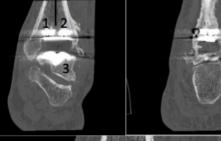
 $59 \pm 11$  years

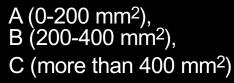
Mean F-up: 13 years ± 6 months

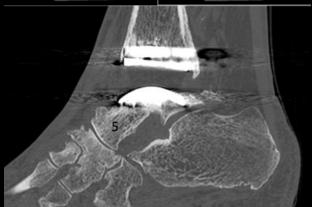
Classic F-up and new CT-scan



- Carbioceram<sup>™</sup> (DLC) stainless steel Implant
- bone-implant interface : alumina
- a dual-curvature PE insert and
- a spherical tibial component







## **RESULTS**

clinical

Mean Fup : 6,7 years ± 3 months Mean Fup : 13 years ± 6 months

20

2012

2016

AOFAS  $33.6 \pm 13.4$ 

 $77.6 \pm 15.4$ 

75 ± 18.2

R.O.M  $23.1 \pm 9.5$ 

28.4 ° ± 10.8

21.6° ± 9.2

5-year survival

change of at least one metal component

75,4%

82.7%

2 fusion1 talar revision

#### radiological

22% of all cysts increase in volume +47%

Cysts Type A (<200 mm<sup>2</sup>)

93 %

90.6%

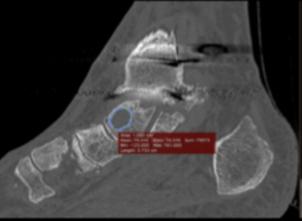
Type A less 100 mm<sup>2</sup>

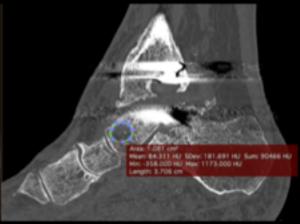
80 %

80%

CT scan analysis







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

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.

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

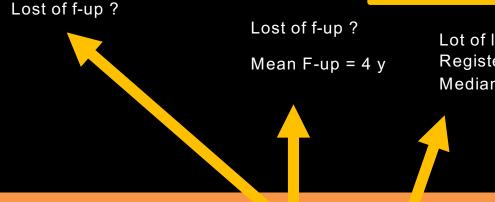
				Year	Number	5y survival	10y survival
	STAR	Anderson	Sweden	2003	51	70,0	-
Mean F-up = 3.8 y	STAR	Wood	UK	2008	200	93,3	80,3
Mean F-up = 9.1 y	STAR	Mann	USA	2011	84	96,0	90,0
	STAR	Brunner	Switzerland	2013	77	-	70,7
Mean F-up = 6.3 y	Hintegra	Barg	Switzerland	2013	684	94,0	84,0
	STAR	Kerkhoff	Netherlands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

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



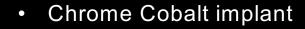
Lot of lost Register incomplete Median F-up = 2.3 y

Methodological weaknesses No clinical assessment Mean F-up = 3.2 y

			<u> `ar</u>	Number	5y survival	10y survival	
STAR/AES/HINTEGRA	Henricson	Sweden	2007	531	78	62	
MOBILITY  NORWEGIAN TPR	Fevang	Norway	2007	.57	89	76	
STAR/AES HINTEGRA							
AGILITY/ RAMSES MOBILITY/STAR	Hosman	New zealand	.J07	202	86	-	
STAR/AES	Skyttä	Finland	2010	515	83	-	

### Third generation mobile bearing.

- Carbioceram<sup>™</sup> (DLC) stainless steel Implant
- bone-implant interface : alumina
- a dual-curvature PE insert and
- a spherical tibial component



- 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 ?