

POSTOPERATIVE DROPFOOT AFTER CEMENTLESS TOTAL HIP ARTHROPLASTY

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From 1989 through 1993, postoperative dropfoot occurred in seven patients after noncemented total hip replacement. After analysis of the records and a review of the literature the authors assume that cementless components may be a contributory factor to sciatic nerve palsy in total hip replacement, especially in combination with Low Molecular Weight Heparin.

Keywords : Cementless ; dropfoot ; hip ; arthroplasty ; nerve injury.

Mots-clés : Sans ciment ; pied tombant ; arthroplastie ; hanche ; lésion nerveuse.

INTRODUCTION

Nerve palsy after total hip replacement is an uncommon but disturbing event for both the patient and the surgeon. The reported incidence varies between 0.3% and 4% in primary total hip replacement and from 2.9% to 7.5% in revision surgery (1, 3, 5, 10, 11, 12, 13, 16). In a prospective study of 30 hip arthroplasties, Weber *et al.* (16) found subclinical electromyographic evidence of nerve impairment in 70% of these hip replacements. In all surgical procedures a transtrochanteric approach was used.

Several contributory factors to nerve palsy have been described. Usually these risk factors are based on a retrospective statistical analysis of records or on associations observed. These contributory factors can be divided into two groups. Risk factors concerning the patient have been delineated : female sex, weight excess, an ankylosed hip and congenital hip dislocation or subluxation. A few authors have associated nerve palsy with preexisting pathology of the lumbar spine (12, 14).

It is still not obvious whether this has to be considered as an aggravating factor or as the cause of neuropathy.

Risk factors relating to the operation include : a posterior or transtrochanteric approach, revision surgery and limb lengthening procedures (10, 11, 12, 13).

Although known contributory factors are easy to recognize, the exact origin of nerve palsy after total hip arthroplasty is generally more difficult to identify. Commonly the precise etiology of nerve injury is unknown or speculative (5, 10, 11, 13).

Nerve injury may arise during or after the operation. During the operation neuropathy may be caused by direct trauma, by compression from instruments, perforating parts of the prosthesis or bone cement. In the latter case, the thermic effect of methylmethacrylate may also be responsible. Distraction of the nerve during limb lengthening may be another reason for nerve damage (10, 11, 12, 13). Following the operation neuropathy may be caused by external compression or by internal compression and ischemia due to postoperative edema, hematoma formation or intraneural bleeding (7, 9, 10, 11, 12, 13, 15).

Additionally, when postoperative dropfoot exists, localizing the lesion is often difficult, clinically and electromyographically. However, accumulating evidence suggests that the nerve injury

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occurs mainly proximal to the level of the arthroplasty and affects the sciatic nerve or the peroneal division of the sciatic nerve (10, 11, 16). Nevertheless, Wagner described four patients with paralysis of the peroneal nerve at the level of the proximal fibula (15).

PATIENTS AND METHODS

From 1976 to 1994, 1463 hip arthroplasties were performed by the authors (tables I, IV). Seven cases of postoperative dropfoot occurred between 1989 and 1993 in a series of 421 hip prostheses, of which 325 were cementless total hip arthroplasties. All cases of postoperative dropfoot occurred in this subgroup of 325 noncemented total hip replacements (table I). The question arose whether cementless components might be a contributory factor to neuropathy in total hip replacement.

Therefore, a retrospective study was accomplished of all the records of patients with hip prostheses, from 1976 through 1994. Special attention was given to

changes in the management of hip arthroplasty that could be responsible for postoperative dropfoot (table IV). Statistically, as all data were purely retrospective, no multivariate analysis was performed. The chi square test for proportions was applied.

RESULTS

The authors' policy gradually shifted from cemented to cementless prostheses, at the end of the nineteen eighties (table I). The present routine is noncemented total hip replacement, except in a few cases, for example in severe osteoporosis. In most of these exceptions the femoral stem is cemented, but the acetabular cup is still cementless (hybrid prosthesis).

Currently, in primary total hip replacement a cementless titanium prosthesis (Zweymüller) is inserted, including a threaded (bi)conical socket and a straight stem. In revision arthroplasty and dysplasia of the acetabulum a press fit spherical hydroxyapatite-coated cup (ABG) is generally

Table I. — Number of hip prostheses

	Bipolar prostheses	Cemented total hips	Hybrid total hips	Cementless total hips	Cementless total hips %	TOTAL	Dropfeet
1976	12	28			0%	40	
1977	21	45			0%	66	
1978	23	64			0%	87	
1979	21	71			0%	92	
1980	35	115			0%	150	
1981	22	139			0%	161	
1982	23	115		23	14%	161	
1983	5	4		1	10%	10	
1984	9	11		2	9%	22	
1985	11	9		5	20%	25	
1986	8	22	3		0%	33	
1987	11	7	12	20	40%	50	
1988	16		5	42	67%	63	
1989	15	3	1	54	74%	73	1
1990	17	7	1	63	72%	88	2
1991	10	1	8	71	79%	90	2
1992	11		5	68	81%	84	1
1993	15	1	1	69	80%	86	1
1994	16		1	65	79%	82	
TOTAL	301	642	37	483		1,463	7
%	21	44	2	33		100	0.48

used. Femoral neck fractures in elderly people are treated with a cemented bipolar femoral prosthesis.

In this series of 1 463 hip replacements only seven cases (0.48%) of postoperative dropfoot could be found and these exclusively between 1989 and 1993 in a series of 421 prostheses (1.66%). Dropfoot after hip arthroplasty never developed before 1989, for a total of 960 cases (table IV). The risk of postoperative nerve injury was significantly higher between 1989 and 1993 than before 1989 ($p < 0.001$).

The possible contributory factors for the development of postoperative dropfoot between 1989 and 1993 were analyzed (table IV). All patients except one were female, and a few patients revealed some other known risk factors for the development of neuropathy (table III).

In the patients with postoperative dropfoot no difficulties or complications at surgery were encountered, and known contributory factors related to the operation could not be found. However, in all patients a primary cementless prosthesis was inserted. In all instances an anterolateral approach was used, spinal anesthesia was performed, and all patients received Low Molecular Weight Heparin (LMWH) from the day before the operation. In all patients except one (Patient 7 in table III), a conical Zweymüller (20) cup was inserted.

In the authors' series no sciatic nerve palsies were observed in 122 revisions (75 cemented, 41 cementless, six hybrid and 19 limb-lengthening procedures), but two temporary femoral nerve palsies were documented.

From this study of records five possible contributory factors to sciatic nerve injury or postoperative dropfoot following total hip replacement could be proposed (table IV) :

- the surgical approach ;
- the spinal anesthesia ;
- the use of LMWH ;
- the use of noncemented components ;
- the use of a threaded conical socket.

Statistically, nothing significant could be concluded concerning the direct involvement of an individual risk factor, as too many factors had to be considered during the same period. The association could be stated, however.

Table II. — Number of acetabular cups

Cups	TOTAL	%	Dropfeet	%
<i>Cemented</i>	644	44	0	0
<i>Bipolar</i>	301	21	0	0
<i>Cementless</i>	518	35	7	1.35
Endler	31	6		
Harris	29	6		
ABG	36	7	1	
Zweymüller Conical	341	65	6	
Zweymüller Bicon	81	16		
TOTAL	1.463	100	7	0.48

DISCUSSION

Several studies have suggested that the risk of nerve palsy is higher for women than for men (3, 5, 13, 16). According to Weber *et al.* (16), the sex of the patients was the only factor that showed any correlation with the development of neuropathy following operation. Women showed a definite predisposition to this complication, perhaps due to their smaller bulk of muscle.

Nevertheless, Schmalzried *et al.* (10, 11), did not find sex to be a risk factor. According to Schmalzried *et al.* and Edwards *et al.* (3) revision surgery and limb lengthening are significant factors in the development of sciatic nerve palsies. However, Harris (4) advocated the correction of leg length in revision surgery and reported no cases of nerve palsy. Amstutz *et al.* (1) described five cases of peroneal palsy following revision arthroplasty (7.5%) but found no association with lengthening of the operated limb. In the authors' series, no correlation was apparent between postoperative dropfoot and revision surgery or limb lengthening.

Surgical approach is usually associated with a possible direct trauma to the nerve. However, it is very implausible that direct trauma to the sciatic nerve occurred exclusively between 1989 and 1993 in 421 hip replacements and not between 1976 and 1988 in 960 hip arthroplasties. Moreover, all operations were performed with the same anterolateral approach, by the same surgeons. Additionally, according to Edwards *et al.* (3), direct trauma to the sciatic nerve is unlikely with an anterior approach.

Table III. — Known contributory factors concerning the patient

Nr	Operation date	Age	Sex	Overweight	Radiculopathy	Ankylotic hip	Subluxation of hip
1	15-03-89	59	M	+	-	-	-
2	26-09-90	58	F	-	+	-	-
3	23-10-90	68	F	-	-	-	-
4	25-09-91	81	F	-	+	-	-
5	16-10-91	68	F	-	+	-	-
6	30-09-92	57	F	+	+	+	-
7	16-09-93	60	F	+	+	+	+

In orthopedic surgery the benefits of thromboprophylaxis and the use of regional anesthesia are well known, but the simultaneous use of both regimens is controversial. No information is available on the incidence of symptomatic and asymptomatic hematomas after regional anesthesia. No prospective randomized trial has been done to evaluate the risk of performing spinal or epidural blocks in patients receiving prophylactic anticoagulants (18, 19).

The authors have used systematic spinal anesthesia for hip arthroplasty ever since 1983 and thromboprophylaxis with LMWH since 1989. However, in the authors' hospital, spinal or epidural anesthesia is performed in hundreds of patients annually and has never been associated with dropfoot, except in the seven cases under consideration.

Therefore, surgical access and spinal anesthesia are not suspect in the dropfoot cases reported here.

Problems with postoperative dropfoot started coincidentally with the introduction of LMWH, as systematic thromboprophylaxis (table IV).

Postoperative dropfoot developed in seven of the 503 patients (1.39%) having received LMWH but in none of the 960 patients treated with Dextran. No significant findings could be inferred however as other variables were not controlled over the same period.

When introducing LMWH prophylaxis in total hip replacement, the authors observed more postoperative swelling and bleeding than with Dextran and they intended to do a prospective clinical trial. As thromboprophylaxis is less effective with Dextran, the authors believed that doing this trial was not acceptable from an ethical point of view. Therefore a prospective randomized double blind clinical trial was started with two different

LMWH's in cementless total hip replacement (publication in preparation). Significant differences were noted in postoperative hematoma and swelling, indicating that LMWH's do play a role in postoperative swelling and hematoma formation. Furthermore, neuropathy has been associated with anticoagulant therapy in several other reports (2, 6, 13, 17).

In seven of the 483 cementless total hip replacements (1.45%), postoperative dropfoot occurred, and no such cases were present in the 980 other hip arthroplasties. Moreover, all cases of postoperative dropfoot occurred between 1989 and 1993 in a series of 325 noncemented total hip prostheses (2.15%). Again no significant conclusions can be drawn, as other elements could be responsible.

However, according to Amstutz *et al.* (2), after cementless total hip replacement, the rate of bleeding and bleeding complications is higher than after conventional replacement with cement. This may be explained by the fact that there is no cement to tamponade the bleeding from the bone.

Nevertheless, hematoma formation can be reduced by meticulous soft-tissue hemostasis, the application of Spongostan or bone wax to bleeding cancellous surfaces and Redon drainage.

In six of the seven patients with postoperative dropfoot a threaded conical Zweymüller cup was inserted (table II). The sciatic nerve, as it passes distally, is intimately related to the posterior portion of the acetabulum (16). The acetabular cup is the prosthetic component with the closest relationship to the sciatic nerve and in the authors' opinion this is the most questionable part of the prosthesis. To insert a conical cementless cup, more extensive reaming of the acetabulum is necessary and sometimes a small perforation of the medial

Table IV. — Number of prostheses and possible contributory factors at surgery

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	TOTAL																		
Hospital	Slotervaartziekenhuis Amsterdam																			Eeuwfeestkliniek Antwerpen																		
Number of prostheses	40	66	87	92	150	161	161	10	22	25	33	50	63	73	88	90	84	86	82	1,463																		
Number of dropfeet														1	2	2	1	1		7																		
Anterolateral approach																																						
General anesthesia																																						
Spinal anesthesia																																						
Dextran																																						
LMWH																																						
More cemented prostheses																																						
More cementless prostheses																																						
Cemented cups only																																						
Endler cups																																						
Conical Zweymüller cups																																						
Bicon Zweymüller cups																																						

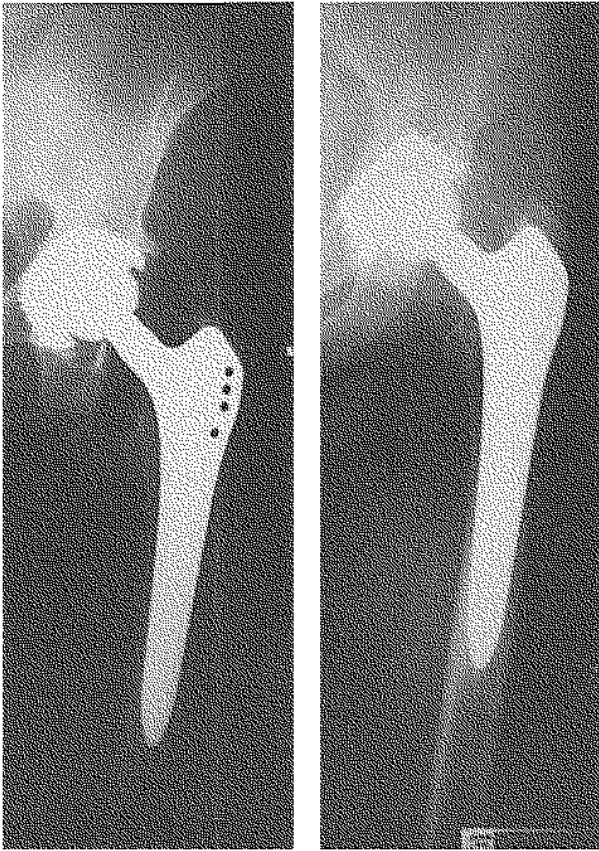


Fig. 1. — A Zweymüller conical cup on AP and acetabular view, perforating slightly the medial acetabular wall.

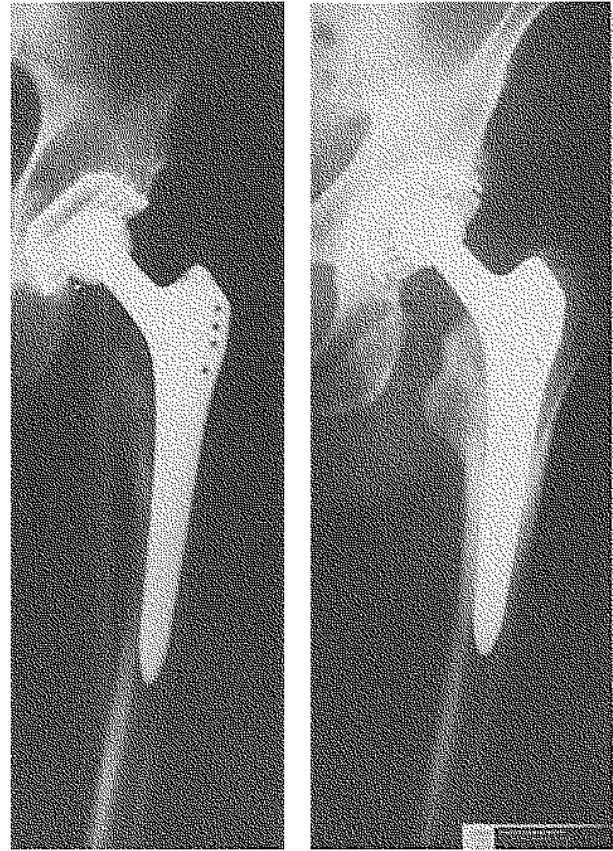


Fig. 2. — The Bicon cup on acetabular and AP view.

acetabular wall occurs (fig. 1). This may lead to the formation of a retroacetabular hematoma, not accessible for Redon drainage, and in turn responsible for sciatic nerve compression, ischemia or intraneural bleeding.

This perforation of the acetabular wall is usually not noticeable on xrays, as the cup does not necessarily perforate the acetabulum, even when a perforation has been created by the reamer. Moreover, a perforation of the socket is poorly visible on a standard AP and lateral xray. Therefore a special "acetabular view" should be made, as described by Linclau *et al.* (8).

Recently Zweymüller (20) has changed the design of the cup to a biconical shape (Bicon cup) to avoid extensive acetabular abrasion and perforation (fig. 2). The authors have used this cup since October 1993 and until August 1995, with 139 cementless total hip replacements, no postope-

rative dropfoot occurred. However, from a statistical point of view nothing significant can yet be concluded. Nevertheless after the implantation of about 200 Bicon cups, without postoperative dropfoot, the data may become significant, as all other risk factors for the development of neuropathy remain unchanged.

CONCLUSION

This report is intended as a warning of the association of postoperative dropfoot and noncemented total hip replacement and/or the administration of LMWH.

From a statistical point of view, no direct evidence is yet available, except the time correlation. However, during this period, LMWH and cementless components are under direct suspicion as risk factors for the development of postoperative drop-

foot. In particular, cementless cups that may perforate the acetabular wall are highly suspect.

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SAMENVATTING

L. LINCLAU, G. DOKTER, PH. GUTWIRTH. Postoperatieve dropfoot bij cementloze totale heupprothesen.

Tussen 1989 en 1993 werd bij zeven patiënten, bij wie een cementloze totale heup prothese werd ingebracht, een postoperatieve dropfoot vastgesteld.

Gebaseerd op een statistische analyse van patiëntendossiers en een literatuurstudie, zijn de auteurs van mening dat een cementloze heupprothese het ontstaan van een postoperatieve parese van de nervus ischiadicus kan bevorderen, vooral in combinatie met laag moleculair gewicht heparines. In het bijzonder zijn cups die het acetabulum kunnen perforeren, zeer verdacht.

RÉSUMÉ

L. LINCLAU, G. DOKTER, PH. GUTWIRTH. Pied tombant par atteinte du nerf sciatique après arthroplastie de la hanche par prothèse totale sans ciment.

De 1989 à 1993, sept patients ont présenté un pied tombant par atteinte du nerf sciatique après implantation d'une prothèse totale de hanche non cimentée. Une analyse statistique des dossiers ainsi qu'une revue de la littérature semblent indiquer qu'une arthroplastie de hanche par prothèse totale non cimentée peut comporter un risque accru d'atteinte du nerf sciatique, particulièrement si l'on y associe l'administration d'héparines de faible poids moléculaire.