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Knee arthrodesis with the Wichita fusion nail

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Abstract We reviewed 32 patients who all had knee arthrodesis performed after failed knee replacement. The minimum clinical follow-up was 1 year. The arthrodesis was performed by means of the Wichita fusion nail in 11, by external fixation in 15 cases, by plating in three and by intramedullary nailing in three. The mean patient age was 68.6 years. When the Wichita nail was used, fusion was achieved in ten out of 11 cases after a mean period of 4.5 (3–7) months. Of the remaining 21 patients, fusion was only achieved in 11 cases after a mean period of 6.5 (4.5–10) months.

Résumé Nous avons examiné 32 malades, avec un suivi minimum d'un an, après arthrodèse du genou pour échec de remplacement prothétique. L'arthrodèse a été exécutée au moyen d'un clou de Wichita dans 11 cas, par fixation externe dans 15 cas, par plaque vissée dans trois cas en plaquant et par enclouage centromédullaire dans trois cas en. L'âge moyen des patients était 68.6 années. Quand le clou Wichita a été utilisé la fusion a été réalisée dans 10 cas sur 11 après une période moyenne de 4.5 (3–7) mois. Chez les 21 autres malades, la fusion a été réalisée 11 fois, après une période moyenne de 6.5 (4.5–10) mois.

Introduction

Knee arthrodesis is the treatment of choice for chronic periprosthetic infections, when there is a persistent infection in a revised knee, when the infection is caused by highly resistant micro-organisms, when the extensor

apparatus is absent or when soft-tissue coverage is impossible [2, 6]. In addition, when there is no infection, arthrodesis is indicated in patients with a deficient extensor apparatus for whom revision surgery has failed [6].

External fixation, plate and screw osteosynthesis and intra-medullary nails are the classical methods used when performing a knee arthrodesis. The purpose of this report is to compare the results obtained using these three surgical approaches with the Wichita fusion nail (Stryker Howmedica), which has recently been introduced in our hospital. It is a solid nail made of vitallium. It is composed of four basic components: a lag bolt, a femoral component, a tibial component and transverse locking screws. The nail permits intra-operative joint compression while maintaining post-operative dynamisation. This favours early weight bearing and thus theoretically accelerates joint fusion.

Material and methods

We reviewed 32 patients who all had a knee arthrodesis due to revised failed total knee arthroplasty ($n=29$) or failed aseptic primary knee arthroplasty ($n=3$). A careful study was made of personal histories as well as of surgical procedures, rehabilitation and complications. The minimum clinical follow-up was 1 year.

In septic cases, which were in the majority, the procedure was carried out in two stages. In the first stage, the prosthesis was removed and a spacer with gentamycin was introduced. This was kept in place for 6–8 weeks. In non-septic cases, removal of the prosthetic components and arthrodesis was performed in one stage. In all cases except three, bone grafting (autologous or bank graft) was added.

Twenty-one cases (group A) were performed between 1990 and 2000. External fixation with one or two fixators was used in 15 cases, customised intra-medullary nails in three and plate and screw osteosynthesis in three. Eleven cases (group B) using the Wichita fusion nail were performed between 2000 and 2001. The data collected was statistically processed to compare the results obtained in the two groups.

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Results

Patients' mean age was 68.6 (63–75) years. Twenty-three cases were classified as instances of septic loosening (Table 1). In group A, the mean duration of the procedure was 145 min in group A and 128 min in group B. Blood transfusions were given to 19 patients in group A and to seven in group B ($p < 0.05$) during the first 2 days after surgery. In group A, union was achieved in 11 cases after a mean period of 6.5 (4.5–10) months. In group B, union was achieved in ten cases after a mean period of 4.5 (3–7) months.

In group A, there was one intra-operative femoral shaft fracture caused by the insertion of an intra-medullary nail. In group B, there was a tibial fissure distal to the locking screws caused by introduction of the tibial component. In group A, one patient had paralysis of the external sciatic nerve diagnosed immediately post-operation. The most frequent complications in this group were pin infection (6/15) and implant breakage. In group B, implant removal was performed 8 months after surgery due to infection. All patients in this group complained to a greater or a lesser extent of calf pain because of the nail's point effect, which gradually wore off in the first 2 months in all but

one patient. Furthermore, one patient had venous thrombosis (involving the distal veins) 5 days after surgery.

Discussion

The use of different techniques to perform an arthrodesis of the knee joint yielded different results depending on the system employed. Sharon [7] presents an integration rate of 100% in 11 patients who were subjected to an arthrodesis using double plate and screw osteosynthesis, with a mean fusion time of 5.6 months. There was one stress-provoked femoral fracture 1 month after surgery, which was addressed by replacing the plate with an intra-medullary nail.

In addition, studies have been performed in which results vary as a function of the fixator employed. Garberina et al [5], who used a circular external fixator, presented a success rate of 68% with a complications rate of 84%, the most usual being infection in the pin segment (55%) and non-union (32%).

In 1999 Waldman [10] published a study comprising 21 cases where knee arthrodesis secondary to an infected total knee arthroplasty was performed by means of a

Table 1 Patient details. *FRTKA(S or A)* failed revision total knee arthroplasty (septic or aseptic), *FTKA(A)* failed total knee arthroplasty (aseptic), *WFN* Wichita fusion nail, *EF()* external fixation

(number of fixators), *CIN* customised intra-medullary nail, *P()* plate (number of plates used)

Cases	Group	Diagnosis	Gender	Age	Procedure	Bone graft	Complications	Fusion time (months)
1	B	FRTKA(S)	M	74	WFN	Y		4
2	B	FRTKA(S)	F	67	WFN	Y		4.5
3	B	FRTKA(A)	F	73	WFN	Y	Tibial fissure	7
4	B	FRTKA(S)	M	66	WFN	Y	Late infection (implant removed 8 mos. post-op.)	
5	B	FRTKA(S)	F	63	WFN	Y		4.5
6	B	FRTKA(S)	F	70	WFN	Y		3
7	B	FRTKA(S)	F	68	WFN	Y		4
8	B	FTKA(A)	F	69	WFN	Y	Superficial wound infection	4.5
9	B	FRTKA(S)	M	66	WFN	Y	Distal veins thrombosis	4.5
10	B	FRTKA(A)	F	67	WFN	Y		4
11	B	FRTKA(S)	M	66	WFN	Y		4
12	A	FRTKA(S)	M	68	EF(2)	Y	Pins superficial infection	7
13	A	FRTKA(S)	F	64	EF(2)	Y	Pins superficial infection	8
14	A	FRTKA(A)	F	68	EF(2)	Y		6
15	A	FTKA(A)	F	65	CIN	N		5.5
16	A	FRTKA(S)	F	67	P(2)	Y		4.5
17	A	FRTKA(S)	M	69	EF(1)	Y	Pins superficial infection	7
18	A	FRTKA(S)	F	70	EF(2)	Y	Pins superficial infection	6.5
19	A	FRTKA(A)	F	72	P (1)	Y	Superficial wound infection	8
20	A	FRTKA(S)	M	71	EF(2)	Y		6
21	A	FRTKA(S)	F	66	CIN	Y		6.5
22	A	FRTKA(A)	F	70	EF(2)	N	Pins superficial infection	7
23	A	FRTKA(S)	F	69	EF(1)	Y		5
24	A	FRTKA(S)	M	72	CIN	Y	Femoral fracture	10
25	A	FRTKA(S)	F	67	P(2)	Y	Implant breakage	9
26	A	FRTKA(S)	M	70	EF(2)	N		5.5
27	A	FRTKA(S)	F	65	EF(2)	Y	External sciatic nerve paralysis	5
28	A	FRTKA(A)	F	73	EF(1)	Y		6.5
29	A	FTKA(A)	F	67	EF(2)	Y		4.5
30	A	FRTKA(S)	F	71	EF(1)	Y	Pins superficial infection	8
31	A	FRTKA(S)	M	68	EF(2)	Y		5
32	A	FRTKA(S)	F	75	EF(2)	Y		6

Fig. 1 Wichita fusion nail

titanium intra-medullary nail. Integration was achieved in 20 patients (95%), and in the remaining patient fusion was subsequently achieved by means of bone grafting. Arroyo et al. [1] achieved integration in 90% of their 21 patients using intramedullary nailing. Donley [3] scored a success rate of 85% with the same technique.

External fixation affords a good stability but requires good bone quality and a long period of non-weight bearing, with a low success rate vis-à-vis other methods [9, 11]. Moreover, it is less well tolerated by patients, and there is a relatively high risk of pin infection [5, 8, 10, 11]. It is indicated in patients with persistent active infection who are not eligible for intra-medullary nailing [5].

The use of plate and screw osteosynthesis requires good bone quality. In addition, it requires a long non-weight-bearing period, as well as a second procedure to remove the metal once fusion has taken place [8].

Arthrodesis using intra-medullary nailing is the technique that affords a high success rate with a short fusion time [9, 10, 11]. Unlike other methods, it allows early weight bearing [3, 11] and is the treatment of choice in cases with severe bone loss or very poor bone quality [4, 9, 10].

In the last few years, several types of short retrograde nails have been designed in order to facilitate knee arthrodesis procedures. The Wichita fusion nail (Fig. 1) is a specific system for knee arthrodeses that facilitates pre-operative planning. In our hands, the nail has facilitated a firmer integration in a shorter period of time. Furthermore, surgical time is also shorter, and the rate of intra- and post-operative complications is low.

From a biomechanical point of view, the system is unique, as it allows intra-operative compression at the level of the joint line, maintaining at the same time a post-operative dynamic compression which favours early weight bearing.

We should point out, however, that removal of the device can be rather complex. In our series, we were obliged to extract the nail in one case owing to the persistence of active sepsis. However, tough as it was, the removal did not lead to any technical complication.

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