



## POPLITEAL ARTERY TRAUMA: INTEREST OF THE PROGNOSTIC SCORES: SERIES OF 88 CASES.

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### ABSTRACT

Vascular injuries are increasing each day; and those of the popliteal artery are still of grave prognosis, with a mortality of 5 to 10% and an amputation rate of 20 to 30%. Our study includes 88 patients with popliteal arterial trauma admitted to the vascular surgery "D" of the Ibn Sina hospital in Rabat over a period of 37 years (from January 1980 to January 2017). We tried to compare the results for group A (1980- 1998), with those in group B (1998-2017), allowing to evaluate the contribution of the first study on our attitudes in popliteal vascular injuries, and make practical conclusions. 75 men (85,22%) and 13 women (14.77%) were studied, with an average age of 31,94 years. The etiologies are dominated by blunt trauma (74.3%) with a high incidence of road accidents (50%). Except three patients admitted after a period of one year, and four others admitted after one month, the average time patients admitted to the acute phase was 47h12mn, ranging from 97.9 hours in group A to 21.6 hours in group B. 91% with ischemia (46,6% with complete form), 6.4% showed a pulsatile hematoma, and 19.2% with a state of shock associated. Osteo-articular lesions represented the main associated lesions (50.1%), followed by soft tissue lesions (44.9%), venous lesions (26%) and nerve damage (10.4%). The preoperative arteriography was performed in 44.3% cases (67.6% for group A and 29.5% for group B). The treatment consisted of a primary amputation in 19,3% (29.4% for group A to 13.6% for group B), while 79.5% were revascularized (71.6% for group A 84.1% for group B). Musculoskeletal repair increased from 40.6% for group A to 60.5% for group B. We regret 11 deaths (14.7% before 1998 to 11.3% after 1998) and 21 cases of secondary amputations (17.65% to 27.27% from group A to group B). Meanwhile, 47% of members were saved for group A and the rate improved to 52.27% for group B. In our study we noticed that the prognostic scores of MESS and Lescalie were relatively respected. injuries of popliteal artery, particularly closed ones, should be taken seriously. Prognostic scores can often be helpful in preventing excessive amputations or perilous revascularizations.

**KEYWORDS:** Trauma - popliteal artery - prognostic score.

### INTRODUCTION

Vascular trauma is a typical example of a vascular surgical emergency. Their frequency increases with the frequency of road accidents.

Among the vascular traumas, those involving the popliteal artery with its anatomical particularities which condition the prognosis, are very serious. They involve both functional and vital prognosis.

Despite recent advances in the field of explorations and surgical approaches, the prognosis of these traumas remains serious with a high rate of mortality and amputation.

Through this work we have tried to specify the epidemiological and clinical aspects of the popliteal

artery traumas, the place of the means of exploration and their indications, as well as the different management methods of arterial, Osteo-articular and associated lesions.

The prognostic factors are the object of our study in order to optimize a better management with the minimum of complications, by referring to the retrospective evaluation of the prognostic scores established by several authors to facilitate the determination of the patients candidates to primary amputation and those requiring revascularization.

We tried to propose a management protocol and some recommendations to improve the future of our patients.

## METHODS

This is a retrospective study, involving 88 patients who were treated, in the "D" vascular surgery department of the IBN Sina hospital in Rabat, for the post-traumatic popliteal artery, during 37 years, extended from 1980 to April 2017.

All patients with popliteal artery trauma who were admitted to service, during the study period, after their initial admission to the emergency department, were included in this work.

An exploitation sheet was established to allow to study the various clinical, radiological, therapeutic and evolutionary features.

The analysis of the data was carried out using the SPSS software, in the laboratory of epidemiology at the Faculty of Medicine and Pharmacy of Rabat.

We gave special importance to the determinants in the prognosis of popliteal artery injury. We mainly evaluated the most used prognostic scores namely the MESS score and LESCALIE grid.

We tried to evaluate our patients at the different parameters and to compare attitudes and results between the two periods studied: before 1998 (group A), and after 1998 (group B).

## RESULTS

Epidemiological, clinical characteristics and prognostic scores at the admission of our patients are presented in **table 1**.

**Table 1: Epidemiological and clinical characteristics and prognostic scores at admission of our patients.**

Parameter		Before 1998 :	After 1998 :
		Group a (n=34)	Group : b (n=(54)
Average age		32,6 years	31,36 years
Average time of admission		97,9 hours	21,68 hours
State of shock		10%	11,40%
Patient (bad)		14,70%	29,50%
Polytrauma		17,60%	18,20%
Contusion		52,90%	68,20%
Ischemia	Complete ischemia	38,20%	52,30%
	Relative ischemia	32,40%	29,50%
	Minimal ischemia	2,90%	9,10%
	Ischemia consumed	11,80%	4,50%
Cutaneous opening	Type 1	2,10%	20,50%
	Type 2	38,20%	20,50%
	Type 3	14,70%	20,50%
	Public road accident	50%	50%
	Fall	11,80%	18,20%
	Stab	14,70%	9,10%
	Hunting rifle	5,90%	9,10%
	Other	17,60%	13,60%
Mess score		7,29	6,43
Lescalie score		53,03	35,48

**Table 2** shows the comparison of the two groups in terms of investigations, management and postoperative results of operated patients (**Figures 1, 2, 3, 4 and 5**).

**Table 2: Comparison of the two groups about investigations, management and postoperative results.**

Investigations, Management And Postoperative Results	Group A	Group B
Doppler Echo	11,80%	9,10%
Arteriography	67,60%	29,50%
Arterial Repair	71,60%	84,10%
Fasciotomy	11,80%	45,50%
Venous Repair	14,70%	15,90%
Bone Repair	40,60%	60,50%
Primary Amputation	29,40%	13,60%
Secondary Amputation	17,65%	27,27%

Revascularization Syndrome	15,00%	9,00%
Postoperative Gangrene	14,70%	15,90%
Saved Members	47,05%	52,27%
Death	14,70%	11,30%

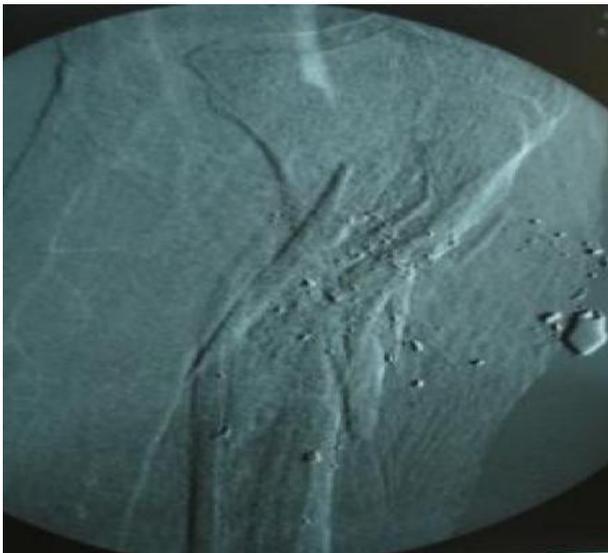


Figure 1: Intraoperative arteriography showing an occlusion of the lower popliteal artery in one of our patients with tibial fracture.



Figure 4: Proximal postoperative control of posterior poplito-tibial bypass grafting by an inverted saphenous vein graft in one of our patients.

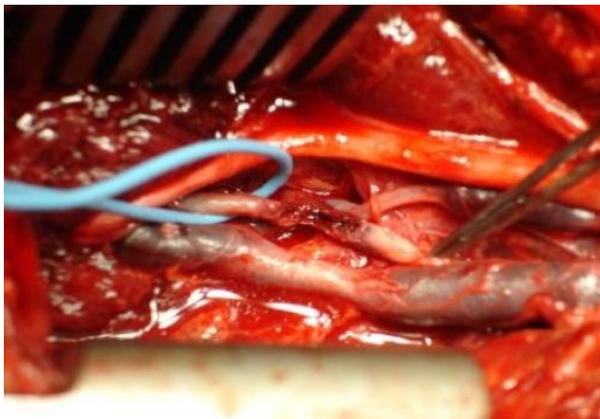


Figure 2: Contused lateral wall of the popliteal artery in one of our patients.

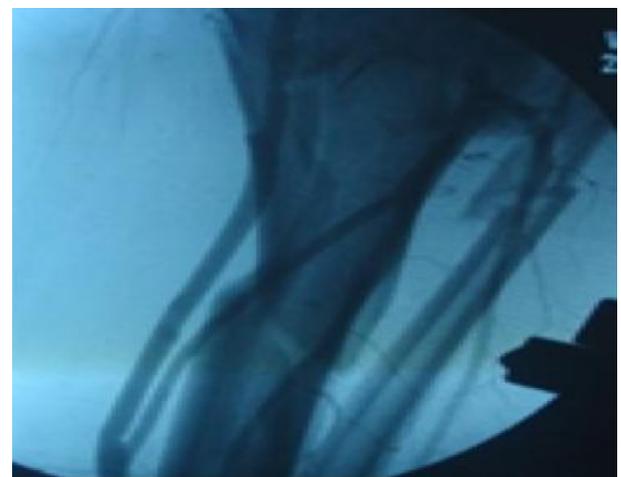


Figure 5: Post-operative distal control of a posterior poplito-tibial bypass graft by an inverted saphenous vein graft, in one of our patients.

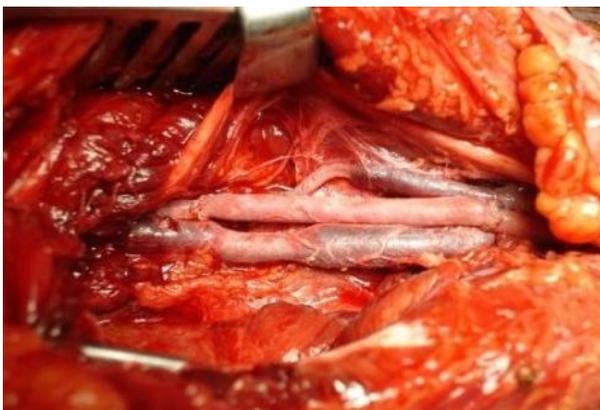


Figure 3: repair by a venous graft in the same patient.

The Long-Term Evolution Of Our Series Are Successively Presented In **Table 3**.

**Table 3: Long-term evolution.**

Evolution	N	%
Favorable	69	78,40%
Peroneal Nerve Paralysis	1	1,10%
Pseudarthrosis	1	1,10%
Death	2	2,30%
Early Deaths	8	9,10%
Unspecified	7	7,95%

**DISCUSSION**

The traumas of the popliteal artery mainly affect the young subject, and are complicated by 30% of

amputation (44.4% in our series) and 5 to 10% of mortality (12.2% in our series).<sup>[1]</sup>

The problems posed by the traumas of the popliteal artery are essentially therapeutic.

Their frequent association with other vital traumatic lesions brings them into the context of polytrauma, thus constituting a multidisciplinary emergency, requiring the intervention of a resuscitator, a radiologist, vascular surgeons, orthopedic surgeons and plastic surgeons, rehabilitator and social assistance.

#### What therapeutic attitude is urgent?

Experience gained during the Second World War has shown that simple ligation of the popliteal artery leads to amputation in 73% of cases.<sup>[2]</sup> The treatment consists schematically either of an amputation from the outset or an attempt to preserve by the repair of the lesions. This decision is the most delicate element of the therapeutic attitude. Primary amputation, often perceived as a failure by the surgeon, may sometimes be excessive, but sometimes it is the only way to save the patient's life, by avoiding inadvertent late revascularization, or by ending scalability of infectious complications. In addition to the arterial trauma itself, many other factors influence the prognosis of popliteal artery injury.

Johancen,<sup>[3]</sup> enumerates, in 1990, 19 parameters that can influence the prognosis of vascular trauma of the limbs: the fracture (level, type, grade), the energy of the trauma, the rupture and tearing of the soft parts, the duration and severity of ischemia, nerve damage (section + rupture), venous lesions, the existence of a syndrome of the lodges, the level of the arterial lesion, the viability of the muscles at the time of the intervention, shock, transfusion, lesion mechanism (penetrating trauma, closed trauma), distance associated lesions, age and associated defects, type of transport (medical or non-medical), treatment in specialized centers or no, the contamination of the lesion and the delay of fixation of a fracture.

**Table 4: The prognostic parameters and their quotation according to LESCALIE.<sup>[6]</sup>**

Time limit	0-8 H: 1	8-12 H: 2	12-36 H: 5	>36 H: 8
Ischemia	minimal : 1	moderate : 2	deferred : 5	Total: 10
Contusion	A: 0	B: 10	C: 20	D: 30
Patient state	Good : 0	bad: 10	Polytrauma: 10	bad + Polytrauma: 20
Cutaneous opening (CAUCHOIX)	No: 0	Type 1: 2	Type 2: 4	Type 3: 10

Score = (time score x ischemia score) + contusion score + field score + skin score.

#### This classification determined 3 groups of patients

- **Group I: score ≤ 40:** revascularization is accompanied by good results. 43 of our patients had a score ≤ 40. 96,65% were revascularized: 100% for group A and 93.3% for group B. There was one death in 14,8% for group A and 3,3% for group B. 85,2% of members were saved for group A and only 70,12% for group B. 3,3% of this group had a

The delay of revascularization, for the majority of the authors, has a paramount importance in the prognosis: it must not exceed 6 hours for Eger, 6 to 12 hours for Majeski and 12 hours for Gordman.<sup>[1]</sup> In our series, the average revascularization time in non-amputated patients was 8 hours.

Ischemia influences the prognosis by its duration, severity and extent. 93.4% of our patients who had a primary amputation, had ischemia (60% complete and 40% consumed) with an average duration of ischemia of 24 hours.

The etiology of the trauma determines its severity. Closed trauma has the highest amputation rate,<sup>[1]</sup> This was the case in 81.4% of our patients who had a primary amputation.

Osteo-articular lesions and soft tissue injuries can sometimes require amputation alone,<sup>[4]</sup> 83.3% of our primary amputees had osteo-articular lesions and 62.5% had soft tissue lesions.

#### Nerve damage poses the problem of the functional future of the limb when it is saved.

Associated lesions remotely in the context of a polytrauma often modify the therapeutic attitude and may prevent revascularization. Taking into account this multitude of factors, a therapeutic decision will be subjective and based on empirical impressions. Several classifications have tried to establish scores assessing the severity of these traumas. Crolais,<sup>[5]</sup> in 1982 proposed a classification based on the analysis of seven parameters: the delay, the contusion, the cutaneous opening, the venous involvement, the ischemia, the ground and the high or low level of the arterial lesion. This study, updated in 1988, will be based on the analysis of five parameters: revascularization delay, ischemia, contusion, terrain and cutaneous opening, rated as shown in **Table 4.**<sup>[6]</sup>

primary amputation and are all in the 2nd period (6,6% of patients of this period).

- **Group II: 41 ≤ score ≤ 50:** conservative treatment runs the risk of a revascularization syndrome, which requires special therapeutic measures. 3 of our patients were classified in this group, with primary amputation and 2 cases of revascularization, of

which one case subsequently had secondary amputation.

- **Group III: score ≥ 51:** Revascularization is contraindicated. In 24 of our patients in this group 50,8% were amputated immediately (58,8% for Group A and 42,85% for Group B). In revascularized patients in this group (49,1% or 41,1% for the 1st period and 57,1% for the 2nd period) 11,7% died for group A against 0 deaths for

group B. 53% members were saved for group A and only 25% for group B.

The analysis of our results, and based on this score, we note the consistency of conduct dictated by Lescalie and our results, this is more marked for the 1st period compared to the 2nd which requires a review of our behavior in terms of the application of this score.

**Table 5: A comparison of our results with the Lescalie grid.**

		group III amputated patient	Groupe I revascularised patient	Patients to amputate (G III) having been revascularized	Patients to revascularize (G I) having been amputated		
Our series	Our series	Our series	Our series	Our series	Our series		
	Before 1998	58,80%	100%	Deaths :14,8%	41,10%	0%	
				Secondary amputation :0%			Deaths :11,7%
				85,2% with good evolution			Secondary amputation: 35,3%
	After 1998	42,85%	93,30%	Deaths :3,3%	57,10%	6,60%	
				Secondary amputation :26,6%			Deaths :0%
70,1% with good evolution				Secondary amputation :75%			
				25% with good evolution			

Peter and Robertson,<sup>[7]</sup> proposed a score: the MESS (Mangled Extremity Severity Score), applied to 152 patients with severe trauma to the lower extremities. This score (Table 6) was established by Johansen and Coll in

Seattle (1990), based on the prospective and retrospective study from the date of admission of patients with severe trauma to the lower limbs.

**Table 6: MESS score.<sup>[7]</sup>**

		score
Trauma	Low energy (stab - simple fracture)	1
	Average energy (staged fracture, open fracture, dislocation)	2
	High energy (bursts of bullet-rifle shots, bullet trauma, crushing)	3
	Very high energy (massive crash)	4
Leg ischemia	Pulse decreased or absent, but normal infusion.	1
	No pulse, paresthesia, decreased capillary pulse.	2
	Coldness, paralysis, numbness, numbness	3
	if time limit > to 6 hours, the score will be multiplied by 2	
Shock	Systolic pressure greater than 90 Hg	0
	Transient arterial hypotension (responds to filling)	1
	prolonged arterial hypotension (corrected in the operating room)	2
Age	< 30 years	0
	30-50 years	1
	> 50 years	2

The evolution of limb ischemia is based on the clinical course of the pulse, perfusion, temperature, sensitivity and movements of the affected limb. The score is doubled if the revascularization time of the infusion exceeds six hours, because the danger of tissue irreversibility becomes greater.

The severity and durability of hypotension affect the score.

The experience in Seattle had shown that if the MESS ≥ 7, it predicts the need for amputation of the severely traumatized limb.

In our series, 36 patients had a MESS $\geq$ 7 score of 46, 15%, of which 50,8% were initially amputated (55,5% for group A and 27,7% for group B). In the 49,1% revascularized with MESS <7 (44,4% before 1998 and 66,6% after), 12% died for group A and 7,6% for group B, the saved members were represented 12,5% for group A and 46,15% for group B.

In patients who had a score > 7 ; 96,65% were revascularized (100% for group A and 95,5% for group B), of which 7,1% died for group A and 4,7% for group B. Member rescue was at 92,9% for group A and 71.5% for group B (Table 7).

**Table 7: Comparison of our results with MESS.**

		Amputated Patients with MESS $\geq$ 7	revascularized Patients with MESS <7	Patients to amputate (MESS $\geq$ 7) having been revascularized		Patients to revascularize (MESS<7) having been amputated
Our series	The whole series	50,80%	96,65%	49,10%		2,25%
	Before 1998	55,50%	100%	44,40%	Deaths: 7,1% Secondary amputation :0% 92,9% with good evolution	0%
					Deaths:12,5% Secondary amputation :46,15% 46,15% with good evolution	
	After 1998	27,70%	95,65%	66,60%	Deaths:4,7% Secondary amputation :3,8% 71,5% with good evolution	4,50%
Deaths:7,6% Secondary amputation :0% 41,66% with good evolution						

By analysing of these results, we find that for the MESS score, as well as for the Escalie grid, the attitude is respected for the revascularization especially for the 1st period, whereas the indication of the primary amputation has not always been respected. In fact, excessive revascularizations were used, especially in the 2nd period. The conservative attitude adopted more and more after 1998, with an often unfavourable evolution, require us to review our adopted attitudes regarding the initial therapeutic decision, respecting the recommendations of the prognostic scores. Peter and Robertson.<sup>[7]</sup> concluded that any score that would allow the indication of amputation should have a high degree of specificity. In their study (in 1991), there were no false positives indicating 100% specificity. If the use of these trauma severity scores seems essential. It should be known that in many situations, the decision of whether to keep the traumatized limb is taken, while the criteria are contentious. Georgiadis.<sup>[8]</sup> thinks that all the scores already proposed by different authors remain insufficient, their use has always resulted in situations where the initial judgment to retain the limb has ended either by a secondary amputation after many interventions and a long period of time. hospitalization (this is the case in 14.2% of our patients according to MESS, and 16.3% according to Lescalie), either by a mediocre result after such great efforts.

Thus, they suggest that there is still a need to improve these criteria taking into account not only the severity of the lesions and the patient's overall condition, but also his psychosocial profile and profession. This is to say the interest of the contribution of the experience of the medical-surgical team taking care of the patient.

**CONCLUSION**

Popliteal vascular trauma is serious because of the frequent association of osteo-articular damage, soft-tissue contusion, and the effects of ischemia, thus putting the vital and functional prognosis at risk. Road accidents dominate the etiological circumstances of these traumas in our context. In the majority of cases, the diagnosis of popliteal artery trauma is obvious, but some forms require the ability of the practitioner with the use of complementary examinations, especially Doppler ultrasound, which can be invaluable in deciding what to do. Arteriography is the key examination, but its implementation should not delay surgical management. It is indispensable in closed vascular trauma and sub acute or secondary ischaemia. The therapeutic decision is facilitated by prognostic scores that point to revascularization or primary amputation. The improvement of the prognosis, in case of arterial restoration, goes through wide indications of fasciotomy, the repair of the associated lesions bone, venous and soft parts, with a multidisciplinary decision for a better chronology of the gestures.

The Amputations from the start being justified only in the face of irreversible ischemia, seen too late and at any time an association of great decay impossible member. While secondary amputation is imperative in the face of revascularization failure and debatable in the face of major neurological sequelae rendering the limb unusable. In the current context, patient admission times were too long, unfortunately, amputation was used in approximately 44.6% of cases. A quick transfer of blessings, early diagnosis and correct treatment are essential elements of therapeutic success.

Improving the prognosis of these traumas requires early pre-hospital and hospital care, with a rapid transfer or even decentralization of care for this type of injury through the creation of regional specialized centers.

We also insist on the improvement of the medical treatment of this traumatism, this goes through a deepening of the knowledge on the pathophysiological consequences of the revascularization syndrome (main cause of death).

Finally, vascular trauma is the typical example of surgical emergencies, so it is imperative that any surgeon be able to cope with this kind of situation.

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