wjpmr, 2024, 10(1), 32-37

SJIF Impact Factor: 5.922

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

Research Article

ISSN 2455-3301

WJPMR

INFLUENCE OF PERSISTENT MEDIAL LAXITY ON THE RESULTS OF SEQUENTIAL STANDARDIZED SURGICAL MANAGEMENT OF TERRIBLE TRIADS OF THE ELBOW

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Article Received on 16/11/2023 **Article Revised on 06/12/2023** **Article Accepted on 26/12/2023**

ABSTRACT

The objective of this work was to study the influence of persistent medial laxity, without instability of the elbow in flexion extension, on the functional and radiological results of the surgical management of acute acute triads of the elbow according to a standardized protocol. sequential with the principle of restoring the stabilizing bony structures (coronoid process and radial head) and repairing the lateral collateral ligament.

KEYWORDS: Medial laxity- Elbow.

A) INTRODUCTION

The term “terrible triad” used by Hotchkiss,[1] combines a posterior dislocation of the elbow, a fracture of the radial head and a fracture of the coronoid process.

This complex elbow dislocation has been known to have poor outcomes in terms of pain, instability, stiffness and osteoarthritic degradation[2,3]

Surgical treatment is required in almost all cases,[4] due to its very unstable nature.

It has been proven that by using a surgical technique according to a sequential standardized protocol, better results can be acquired.[3,5,6] The principle of this technique consists of the restoration of the stabilizing bony structures, which are the coronoid process and the radial head, as well as the repair of the lateral collateral ligament plane.

Repair of the medial collateral ligament plane remains controversial, not necessary for some and justified only in cases of persistent instability in flexion and extension for others.

The objective of this work was to study the influence of persistent medial laxity, without instability of the elbow in flexion extension, on the functional and radiological results of the surgical management of acute acute triads of the elbow according to a standardized protocol.

B) MATERIEL AND METHODES

This is a retrospective study carried out on patients operated at the Vichy Hospital center for a terrible elbow triad between January 2017 and March 2021; The inclusion criteria were: acute care, a standardized surgery and physiotherapy protocol and a minimum follow-up of 12 months.

The exclusion criteria were the need for repair of the medial collateral ligament and the placement of an external fixator, two patients were excluded from our study, the first had presented instability of the elbow in flexion extension after repair of the lateral plane (radial head and lateral collateral ligament) and the coronoid process having required repair of the medial ligament plane and the installation of an articulated external fixator, the second patient had presented insufficient stabilization of a Metaphyso fracture epiphyseal of the upper end of the radius with early disassembly and dislocation of the elbow requiring prosthetic replacement of the radial head and the installation of an external fixator; Of the 12 patients who met the inclusion criteria, one patient was lost to follow-up, so the study included 11 patients.

Two groups were formed according to the presence or absence of isolated persistent medial laxity (not leading to instability of the elbow in flexion and extension), group 1 without medial laxity included 7 patients (Table 1) and group 2 with laxity. medial had 4 patients (Table

2); High kinetic energy trauma (fall from a high place, AVP, fall from a bicycle) was found in 72% of cases and no acute, cutaneous, vascular or neurological complications were found.

An initial radiological assessment including standard frontal and lateral x-rays of the elbow before and after reduction (figures 1 and 2), as well as a CT scan after reduction of the dislocation (figure 3) were systematically carried out in all our patients.; Radial head fractures were classified according to the Mason classification modified by Johnston.[7] In our series, seven patients presented with type 2 radial head fractures and four patients with type 3 fractures; For fractures of the coronoid process, two classifications were used, that of Regan and Morrey.[8] which distinguishes 3 types: Type 1: tip fracture; Type 2: fracture less than 50% of the height of the coronoid process; Type 3: fracture greater than or equal to 50% of the height of the coronoid process and that of Odriscoll.[9] which also distinguishes 3 types: Type 1: fracture of the tip, Type 2: fracture of the anteromedial facet, Type 3: fracture greater than or equal to 50% of the height of the coronoid process;

Figure 1 : Radiographie du coude de Profil avant réduction

Figure 2 : Radiographie du coude de profil après réduction

Figure 3 : TDM du coude après réduction de la luxation

Surgical treatment was carried out after an average of 4 days from the trauma and according to a sequential standardized protocol, all our patients were placed in the supine position, upper limb on an arm table, tourniquet at the root of the limb and operated under general anesthesia associated with locoregional anesthesia, a posterolateral cadenat approach was systematically performed, supplemented by a medial approach to fix the coronoid process when the radial head was osteosynthesized.

Coronoid process fractures were managed according to the Regan and Morrey classification, antegrade screw fixation was performed for all type 2 fractures, for the four type 1 fractures, two were treated orthopedically, and the two others were reinserted by anchor.

The radial head fractures were either osteosynthesized with buried head screws, which was the case in five patients, or replaced by a prosthesis, which was done in the other six patients.

The lateral collateral ligament found to be ruptured in all of our patients was systematically reinserted by anchor on its isometric point in the center of the lateral epicondyle, to avoid any varus or posterolateral instability,[10] Reinsertion of the dynamic epicondylar stabilizers was carried out in six patients in our series.

After the restoration of the bone stabilizers and repair of the lateral collateral ligament, the stability of the elbow was tested under image intensifier in flexion extension and varus valgus; Due to the absence of elbow instability in flexion and extension in the 11 patients in the series, no repair of the medial collateral ligament was performed despite the presence of persistent medial laxity in the four patients in group 2.; Postoperative radiological control was carried out using standard frontal and lateral x-rays of the elbow (figures 4 and 5).

Postoperatively, the elbow was immobilized at 90° of flexion by a brachio-antebrachio-palmar circular resin, with the forearm in pronation for 15 to 21 days, the resin was then replaced by an articulated splint blocking the forearm in pronation and limiting extension to – 30° for 4 to 6 weeks, thus allowing active mobilization of the elbow to begin in flexion extension, and in prono supination elbow to 90° flexion. Complete extension of the elbow was delayed until 8 to 9 weeks.

Patients were seen regularly in consultation for clinical and radiological follow-up on D8, D21, D45, then every 3 months for the first year.

Figure 4 : Radiographie de contrôle du coude de face

Figure 5 : Radiographie de contrôle du coude de profil

Tableau 2 : Population groupe 2

					Classifications		Prise en charge chirurgicale		
N°	Age	Sexe	Mécanisme	Coté	TR (Mason)	AC (Regan et Morrey)	Délai en jours	Tête radiale	Apophyse Coronoïde
1	28	M	Accident de vélo	Dominant	2	2	4	Vissage	Vissage
2	58	F	AVP	N / dominant	2	2	7	Prothèse	Vissage
3	36	M	Chute de lieu élevé	Dominant	2	2	0	Vissage	Vissage
4	69	F	Chute de sa hauteur	N / dominant	3	1	5	Prothèse	Suture
Min	28						0		
Max	69						7		
Médiane	47,00						4,50		
Moyenne	47,75						4,00		

TR : Tête radiale ; **AC :** Apophyse coronoïde

Tableau 1 : Population groupe 1

					Classifications		Prise en charge chirurgicale		
N°	Age	Sexe	Mécanisme	Coté	TR (Mason)	AC (Regan et Morrey)	Délai en jours	Tête radiale	Apophyse Coronoïde
1	44	M	Accident de vélo	Dominant	2	1	2	Vissage	Suture
2	67	F	Chute de sa hauteur	N/dominant	2	1	8	Prothèse	Orthopédique
3	49	M	Chute de lieu élevé	Dominant	3	2	7	Prothèse	Vissage
4	55	M	Accident de vélo	N/dominant	3	1	5	Prothèse	Suture
5	31	M	Chute de lieu élevé	Dominant	2	1	3	Vissage	Orthopédique
6	26	F	AVP	Dominant	2	2	2	Vissage	Vissage
7	74	F	Chute de sa hauteur	N/dominant	3	2	4	Prothèse	Vissage
Min	26						2		
Max	74						8		
Médiane	49,00						4,00		
Moyenne	49,43						4,43		

TR : Tête radiale ; **AC :** Apophyse coronoïde

C) RESULT

The patients were seen again with an average follow-up of 24.86 months for group 1 and 25.75 months for group 2 without surgical revision being necessary; The average age was 49 years for group 1 and 47 years for group 2; Sex, side, mechanism and time of treatment were without statistically significant difference between the two groups; The coronoid process was repaired in 71% of patients in group 1 and in 100% of patients in group 2; Prosthetic replacement of the radial head was performed in 43% of cases in group 1 and in 50% of cases in group 2.

The average joint range in flexion, extension deficit, pronation and supination were respectively 129.29°, 17.86°, 70.86° and 69.29° for group 1 and 130°, 20°, 70°.° and 72.5° for group 2;

All elbows were stable in flexion extension and varus valgus. The mean MEPS and the mean Broberg and Morrey score were respectively 86.43 and 88 for group 1 and 87.5 and 86.75 for group 2.

All elbows were centered on the radiographic views, grade 1 humero radial joint narrowing was found in two patients (one from each group) and grade 1 humero ulnar joint narrowing was found in one patient from group 1 (figure 5), heterotopic ossifications (figures 5 and 6)

were found in three patients in group 1 and in two patients in group 2.

Figure 5 : patiente revue avec un recul de 13 mois, ossifications hétérotopiques, pincement articulaire humero ulnaire

Figure 6 : patient revu avec un recul de 24 mois, ossifications hétérotopiques, pas de pincement articulaire

The results of the clinical evaluation and radiological evaluation are detailed in Table 3 for group 1 and in Table 4 for group 2; No statistically significant difference between the two groups regarding mobility, functional scores, osteoarthritis and heterotopic ossifications was found, the results are detailed in table 5.

Tableau 3 : Résultats du groupe 1

N°	Recul en mois	Flexion	Extension	Arc flexion extension	Pronation	Supination	Arc prono supination	MEPS	Score Broberg et Morrey	Arthrose	Ossification Hétérotopiques
1	20	130°	5°	125°	80°	80°	160°	100	100	0	0
2	13	120°	20°	100°	80°	70°	150°	80	83	1	0
3	41	130°	20°	110°	75°	80°	155°	95	92	0	1
4	16	130°	25°	105°	60°	60°	120°	75	84	0	0
5	24	130°	10°	120°	70°	75°	145°	85	92	0	1
6	21	140°	15°	125°	80°	70°	150°	95	93	0	0
7	39	125°	30°	95°	65°	50°	115°	75	72	1	1
Min	13	120°	5°	95°	60°	50°	115°	75	72		
Max	41	140°	30°	125°	80°	80°	160°	100	100		
Médiane	21,00	130°	20°	110°	75°	70°	150,00°	85	92		
Moyenne	24,86	129,29°	17,86°	111,43°	72,86°	69,29°	142,14°	86,43	88		

Tableau 4 : Résultats du groupe 2

N°	Recul	Flexion	Extension	Arc flexion extension	Pronation	Supination	Arc prono supination	MEPS	Score Broberg et Morrey	Arthrose	Ossifications péri articulaires
1	29	140°	20°	120°	80°	80°	160°	100	100	0	0
2	12	125°	25°	100°	70°	70°	140°	75	73	0	0
3	27	130°	15°	115°	75°	80°	155°	95	92	0	1
4	35	125°	20°	105°	55°	60°	115°	80	82	1	1
Min	12	125°	15°	100°	55°	60°	115°	75	73		
Max	35	140°	25°	120°	80°	80°	160°	100	100		
Médiane	28,00	127,5°	20°	110°	72,5°	75°	147,5°	87,5	87		
Moyenne	25,75	130°	20°	110°	70°	72,5°	142,5°	87,5	86,75		

D) DISCUSSION

The management of the medial collateral ligament remains controversial in the literature between non-repair and repair only in the presence of persistent instability of the elbow; In the series by Forthman et al[20] published in 2007, 34 patients were operated on for dislocation and fracture dislocation of the elbow, including 22 patients operated on for terrible triad of the elbow according to a standardized protocol, with in all cases, repair of the elbow. the coronoid process, osteosynthesis or prosthetic replacement of the radial head, repair of the lateral collateral ligament and no repair of the medial collateral ligament without specifying the presence or absence of associated medial laxity, the authors found for the terrible triads of the elbow operated on: 77% good and excellent results, an average arc of prono supination at 137° and an average arc of flexion extension at 117°, they concluded that the stability of the elbow and proper functioning satisfactory can be restored without repair of the medial collateral ligament with the explanation being the sufficiency of the restoration of the stabilizing bony structures, the repair of the Lateral Collateral Ligament and the dynamic components as well as the healing potential of the medial collateral ligament.

In the series by Pugh et al,[6] which included 36 patients operated on for terrible elbow triad according to a

standardized protocol with an average MEPS of 88, average joint range of motion in flexion/extension of 131°/19° and an arc mean prono supination at 136°, the authors considered that the decision to perform a medial approach is only taken in the event of persistent sagittal instability after primary osteosynthesis of the coronoid process, osteosynthesis or prosthetic replacement of the radial head and repair of the lateral ligamentous plane, and that isolated frontal, valgus instability is not an indication for systematic repair of the medial collateral ligament to the extent that the elbow remains stable in flexion-extension, which corresponds to the approach of Morrey et al,[16] and to ours; Chemama et al,[22] published a study in 2009 which focused on 24 elbows (23 patients) operated on for terrible triad according to a standardized protocol, of which 14 elbows (13 patients) were reviewed with an average follow-up of 63 months with a MEPS average at 89, an average arc of flexion/extension at 109° and an average arc of prono supination at 133°, for the authors, the indication of a medial approach is only posed in the face of the persistence of an instability in flexion-extension and/or great valgus instability, without having given an objective value.

For Antoni et al,[18] reinsertion of the Medial Collateral Ligament is only indicated in the event of persistence of medial valgus instability after standardized surgery.

Some authors have not found a parallel between the clinic and the anatomical lesions; In the series by Chemama et al, of the nine elbows approached via the medial approach, six had a lesion of the medial collateral ligament; Galbiati et al,[23] in three patients presenting a clinical examination compatible with a lesion of the medial collateral ligament, no lesion of the latter was found during surgical exploration.

Faced with persistent instability, some authors recommend primary repair of the medial collateral ligament, and if stability is not restored, insertion with an external fixator,[24 - 26] while others opt for a protective external fixator.[15]

Our study presents several limitations which are related to its retrospective nature, to the low number of patients due to the rarity of this complex elbow fracture, as well as to a subjective intraoperative evaluation of medial laxity, highlighted by a clinical test and by the presence of a medial yawn under image intensifier without angular measurement.

However, apart from the experiences and indications reported by certain authors concerning the management of the medial collateral ligament, we have not found any study in the literature assessing the influence of persistent medial laxity on the results of surgical management. terrible triads of the elbow or determining a tolerable limit to this laxity.

A study on a larger number of patients, with an intraoperative angular measurement of medial laxity could provide information, apart from elbow instability in flexion extension, on the presence of a critical angular limit to medial gaping, indicating the repair of the medial collateral ligament.

E) CONCLUSION

The surgical management of the terrible triad of the elbow according to a sequential standardized protocol which consists of the restoration of the stabilizing bony structures (coronoid process and radial head) and the repair of the lateral collateral ligament allowed us to restore satisfactory function of the elbow. with an average follow-up of 25 months, without the functional and radiological results being compromised by persistent medial laxity, the isolated nature of which, without instability of the elbow in flexion extension does not constitute for us an indication for repair of the medial collateral ligament.

Consent

The patients have given their informed consent for the case to be published.

Competing Interests

The authors declare no competing interest.

Authors 'Contributions

All authors have read and agreed to the final version of this manuscript and have equally contributed to its content and to the management of the manuscript.

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