

Prevalence of Neuropathic Pain in Patients with Fracture of the Distal Extremity of the Radius Treated with Volar Locking Plate

Prevalência de dor neuropática em pacientes com fratura da extremidade distal do rádio tratada com placa volar bloqueada

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Abstract

Keywords

- ▶ radius fractures
- ▶ pain measurement
- ▶ postoperative complications
- ▶ fracture fixation, internal

Objective To evaluate the prevalence of persistent pain in the postoperative period of fractures of the distal extremity of the radius, as well as to detect early signs of neuropathic pain to develop protocols for the prevention of chronic postoperative pain.

Methods Prospective study, carried out with 56 patients who underwent open reduction and internal fixation of fractures of the distal extremity of the radius with a volar locking plate from March to September 2020. The patients were submitted to assessment of neuropathic pain and functional capacity through the Douleur Neuropathique 4 questionnaire (DN4) and Quick Disabilities of the Arm, Shoulder, and Hand (Quick-DASH) questionnaires. Qualitative variables were compared using the Mann-Whitney U test and their correlation was analyzed using the Spearman Correlation and Equality of Two Proportions tests.

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Results A total of 43 patients aged between 18 and 66 years old were included in the present study; 39.5% of the participants scored ≥ 4 on the DN4 questionnaire. In relation to Quick-DASH, the average was 38.6. There was no statistically significant difference between the gender of the patient and the DN4 value ($p = 0.921$). There was also no statistical correlation between the quantitative variables DN4 and Quick-DASH ($p = 0.061$).

Conclusions The prevalence of neuropathic pain in analyzed postoperative patients was significant, and the presence of signs and symptoms of neuropathic pain was a positive predictive factor for pain persistence beyond 2 months in 100% of cases. Thus, with early diagnosis of the neuropathic component of pain, associated with the nociceptive component, adequate pain control can be achieved, preventing its chronicity, and ensuring better rehabilitation.

Resumo

Objetivo Avaliar a prevalência de dor persistente no pós-operatório de fratura da extremidade distal do rádio, assim como detectar precocemente sinais de dor neuropática com o intuito de desenvolver protocolos de prevenção da dor crônica pós-operatória.

Métodos Estudo prospectivo, realizado com 56 pacientes submetidos a redução aberta e fixação interna de fratura da extremidade distal do rádio com placa volar bloqueada no período de março a setembro de 2020. Os pacientes foram submetidos a avaliação de dor neuropática e capacidade funcional através dos questionários Douleur Neuropathique 4 questionnaire (DN4) e Quick Disabilities of the Arm, Shoulder, and Hand (Quick-DASH, na sigla em inglês). As variáveis qualitativas foram comparadas pelo teste de Mann-Whitney e sua correlação foi analisada pelos testes de correlação de Spearman e de Igualdade de Duas Proporções.

Resultados Foram incluídos no presente estudo 43 pacientes, com idades entre 18 e 66 anos; 39,5% dos participantes apresentaram pontuação ≥ 4 no questionário Douleur neuropathique 4 questionnaire (DN4). Em relação ao Quick-DASH, a média foi de 38,6. Não houve diferença estatística significativa entre o sexo do paciente e o valor do DN4 ($p = 0,921$). Também não foi encontrada correlação estatística entre as variáveis quantitativas DN4 e Quick-DASH ($p = 0,061$).

Conclusões A prevalência de dor neuropática nos pacientes pós-operatórios analisados foi significativa e a presença de sinais e sintomas de dor neuropática foi fator preditivo positivo para a persistência da dor além de 2 meses em 100% dos casos. Assim, com diagnóstico precoce do componente neuropático de dor, associado ao componente nociceptivo, é possível obter o controle adequado da dor, impedindo sua cronificação e garantindo uma melhor reabilitação.

Palavras-chave

- ▶ fratura do rádio
- ▶ medição da dor
- ▶ complicações pós-operatórias
- ▶ fixação interna de fraturas

Introduction

Fractures at the distal extremity of the forearm are the most frequent in the upper limb, corresponding to 74% of fractures of the bones of the forearm and to 16% of all skeletal fractures.¹ They can be due to high-energy trauma, usually in young patients, or to low-energy trauma in elderly patients with osteoporosis. When these fractures are irreducible or unstable, surgical treatment is indicated. With the evolution of implants, especially of locking plates for the distal end of the radius, it became possible to reestablish the anatomy of the area, with stable fixation that allows early mobility.² However, despite the excellent radiographic results obtained with the open reduction and internal fixation of these fractures

with volar locking plate, the clinical results are not homogeneous.

Although still poorly documented in the literature, postoperative persistent chronic pain (POCP) has been described as one of the main factors that interfere in the rehabilitation of patients undergoing orthopedic surgery, thus affecting their work capacity and their quality of life.

Postoperative persistent chronic pain is defined as a pain that occurs after a surgical procedure, lasting at least 2 months, and is not related to pre-existing pain nor to other defined etiologies, such as infection, for example.³ Its incidence is very variable, occurring in between 5 and 80% of patients undergoing surgical procedures of various types.⁴ This wide variation may be associated with failures in the assessment and, consequently, in the diagnosis of this health problem.

Interview of the patient

Question 1: Does the pain have one or more of the following characteristics?

1. **Burning**
2. **Painful cold**
3. **Electric shocks**

Question 2: Is the pain associated with one or more of the following symptoms in the same area?

4. **Tingling**
5. **Pins and needles**
6. **Numbness**
7. **Itching**

Examination of the patient

Question 3: Is the pain located in an area where the physical examination may reveal one or more of the following characteristics?

8. **Hypoesthesia to touch**
9. **Hypoesthesia to pinprick**

Question 4: In the painful area, can the pain be caused or increased by:

10. **Brushing**

Yes = 1 point

No = 0 points

Fig. 1 DN4 questionnaire for the diagnosis of neuropathic pain. Source: Santos et al.⁷

In the immediate postoperative period, the direct activation of nociceptors, the inflammatory response, and the possible injury to nervous structures cause, from a clinical point of view, pain at rest at the surgical site and in a nearby region. There is also pain triggered by touch or movement, indicating peripheral sensitization.

A neuropathic component may develop immediately after surgical trauma and persist in the absence of peripheral nociceptive or inflammatory stimulus. Thus, defining neuropathic pain is essential to develop prevention and treatment strategies for persistent chronic pain.^{5,6} The Douleur neuropathique 4 questionnaire (DN4),⁷ in the version translated into Portuguese for Brazil, has been widely used as an instrument for screening neuropathic pain, as it is easy to apply by both pain specialists and nonspecialists. It consists of seven items that refer to symptoms and another three that relate to the physical examination. Each item scores 1 if the answer is positive and zero if it is negative, leading to a minimum value of zero and a maximum of 10. A sum of points ≥ 4 suggests neuropathic pain.

The aim of the present study is to assess the prevalence of persistent pain in the postoperative period of a fracture of the distal extremity of the radius, as well as to detect early signs of neuropathic pain to develop protocols for the prevention of POCP.

Material and methods

Fifty-six patients, aged at least 18 years old, with fractures at the distal end of the radius, treated at our institution and submitted to open reduction and internal fixation with a volar locking plate, from March to September 2020, were

prospectively evaluated. The exclusion criteria were patients with open fractures, bilateral fractures, associated nerve injuries or even those who presented surgical site infection.

Ten weeks after surgery, each patient was submitted to neuropathic pain assessment using the Brazilian Portuguese version of the DN4 questionnaire (**► Figure 1**). At this time, the Quick Disabilities of the Arm, Hand, and Shoulder (Quick-DASH) questionnaire was also applied (**► Table 1**), also translated into Portuguese, to assess the functional impact on the affected limb. The QuickDASH is a specific questionnaire that assesses the level of disability in patients with various upper limb disorders, associating the symptom and its impact on physical, social, and psychological activity dysfunction. The score is presented on a positive orientation scale from 0 (maximum functionality) to 100 (maximum disability), including 2 optional modules (Work Module and Sports/Performing Arts Module) with 4 items each (1 to 5).⁸ Both questionnaires were always applied by the same evaluator.

Qualitative variables were compared using the Mann-Whitney U test and their correlation was analyzed using the Spearman Correlation and Equality of Two Proportions tests. Excel Office 2010 (Microsoft Corporation, Redmond, WA, USA), IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY, USA) and Minitab 16 (Minitab, State College, PA, EUA) software were used, and statistical significance was considered when the p-value was < 0.05 (5%).

Results

The present study included 43 patients, aged between 18 and 66 years old (mean 42.3 years old); 32 (74.4%) were male and 11 (25.6%) were female.

Table 1 QuickDASH questionnaire

	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable
1. Open a tight or new jar	1	2	3	4	5
2. Do heavy household chores (e.g. wash wall, floors)	1	2	3	4	5
3. Carry a shopping bag or briefcase	1	2	3	4	5
4. Wash your back	1	2	3	4	5
5. Use a knife to cut food	1	2	3	4	5
6. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g. golf, hammering, tennis, etc.)	1	2	3	4	5
	Not at all	Slightly	Moderately	Quite a bit	Extremely
7. During the past week, to what extent has your arm, shoulder, or hand problem interfered with your normal social activities with family, friends, neighbors or groups?	1	2	3	4	5
	Not limited at all	Slightly limited	Moderately limited	Very limited	Unable
8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder, or hand problem?	1	2	3	4	5
Please rate the severity of the following symptoms in the last week. (circle number)	None	Mild	Moderate	Severe	Extreme
9. Arm, shoulder, or hand pain	1	2	3	4	5
10. Tingling (pins and needles) in your arm, shoulder or hand	1	2	3	4	5
	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	So much difficulty that I can't sleep
11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? (circle number)	1	2	3	4	5

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

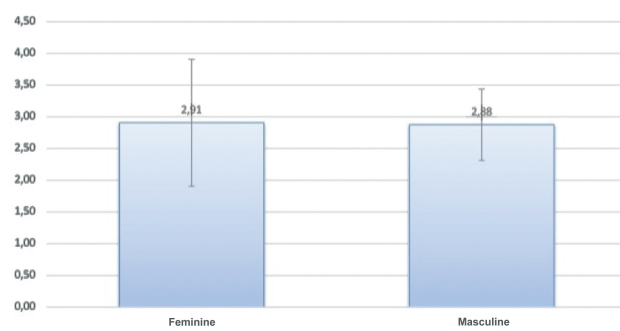
Table 2 Quantitative variables

	Mean	Median	Standard deviation	Minimum	Maximum	CI
Age	42.3	42	14.5	18	66	4.3
DN4	2.88	3	1.62	0	6	0.48
QuickDASH	38.6	35	18.4	15	80	55

Abbreviations: CI, confidence interval; DN4, Douleur Neuropathique 4 questionnaire; QuickDASH, Quick Disabilities of the Arm, Shoulder, and Hand.

The scores obtained with the application of the DN4 questionnaire ranged from 0 to 6, with 17 (39.5%) having a score ≥ 4 , which indicates the presence of a neuropathic component in pain. Regarding the QuickDASH, the score on this questionnaire ranged from 15 to 80, with an average of 38.6. Quantitative variables are represented in ► **Table 2**.

After applying the statistical tests, it was observed that there was no statistically significant difference between the gender of the patient and the DN4 value ($p=0.921$) (► **Figure 2**). There was also no statistical correlation between the quantitative variables DN4 and QuickDASH ($p=0.061$).

**Fig. 2** Distribution of patients with DN4 ≥ 4 by genre.

Discussion

Fractures of the distal extremity of the radius are very frequent and, despite adequate treatment, functional deficits persist. Orbay et al.⁹ reported that, after 1 year of surgery with a fixed-angle volar plate, a loss of grip strength persisted, with an average of 79% in relation to the contralateral side. Catalano et al.¹⁰ observed a significant discrepancy between radiographic results and functional results, suggesting that there are more processes involved than simple fracture reduction and bone union. Persistent pain may be the determining factor for delay in the rehabilitation process, leading to long-term loss of range of motion and strength.

Ibor et al.,¹¹ in a multicenter study with 5,024 orthopedic patients, found that mixed pain was the most prevalent among these patients (59.3%), including postoperative pain. This study also observed that patients with mixed pain have a more complex clinical picture, with a greater impact on quality of life and a higher rate of undertreatment. In our sample, we observed the presence of a neuropathic component associated with pain in 39.5% of the patients.

Of the patients with a neuropathic pain component, it was observed that 8 out of 17 patients (47%) had QuickDASH scores > 50, indicating worse functional outcome, while in patients with DN4 < 4, only 4 out of 26 patients (15, 3%) had scores > 50 on the QuickDASH, suggesting the impact of neuropathic pain on rehabilitation.

In the literature, neuropathic pain is generally more associated with females;¹² however, in the present study, this association was not observed. Likewise, there was no statistically significant difference in QuickDASH results between genders, suggesting that the lesion itself is more important than gender in the development of chronic pain.

According to the definition proposed by Freynhagen et al.,¹³ mixed pain is characterized by the superposition, in the same body segment, of two or more pain mechanisms (nociceptive, neuropathic or nociplastic) and one or another mechanism may predominate along the time, which sometimes makes it difficult to identify all the components. The use of specific tools for neuropathic pain assessment allows the simple and quick identification of this component.

Among the available tools, the DN4 questionnaire, developed in France by Bouhassira et al.¹⁴ in 2005 and translated and approved into Brazilian Portuguese in 2011 by Santos et al.,⁷ is a tracking tool to neuropathic pain, which can be used both by specialists and nonspecialists. It consists of 7 items that refer to symptoms and another 3 that relate to the physical examination. Each item scores one if the answer is positive and zero if the answer is negative. Scores ≥ 4 indicate the presence of neuropathic pain. The results of the validation study in the Brazilian Portuguese version showed 100% sensitivity and 93.2% specificity.

In the present study, an initial DN4 score ≥ 4 was a determining factor for pain persistence, confirming the importance of the neuropathic component of pain. Adequate evaluation, with early diagnosis of the neuropathic component of pain, associated with the nociceptive component, can allow adequate pain control, preventing its chronicity and ensuring better rehabilitation.

Conclusion

The prevalence of neuropathic pain in patients with fractures of the distal extremity of the radius treated with a volar locking plate was significant, reaching 39.5% in the present analysis, and the presence of signs and symptoms of neuropathic pain was a positive predictive factor for the persistence of pain beyond 2 months in 100% of the cases.

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Conflict of interests

The authors have no conflict of interests to declare.

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