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Consensus on the preoperative management of patients with chronic moderate to severe shoulder pain to improve postoperative outcomes: Delphi results

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Background: Appropriate preoperative management of patients with chronic moderate to severe shoulder pain who are candidates for surgery owing to rotator cuff disease or glenohumeral osteoarthritis may improve surgery and patient outcomes, but published evidence in this regard is scarce. Therefore, the availability of recommendations on preoperative interventions based on expert consensus may serve as guidance.

Methods: A Delphi study was conducted to develop a preoperative management algorithm based on a national expert consensus. A Delphi questionnaire was developed by a scientific committee following a systematic review of the relevant literature published during the past 10 years using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) criteria. It consisted of 48 statements divided into 5 blocks (block I, assessment and diagnosis of preoperative pain; block II, preoperative function and psychosocial aspects; block III, therapeutic objectives; block IV, treatment; and block V, follow-up and referral), and 28 experienced shoulder surgeons from across the country were invited to answer.

Results: All participants responded to the Delphi questionnaire in the first round, and 25 responded in the second round (89.3% of those invited). Overall, 46 of 49 final statements reached a consensus, on the basis of which a final preoperative management algorithm was defined by the scientific committee. First, surgeons should assess shoulder pain intensity and characteristics, shoulder functionality, and psychosocial aspects using specific validated questionnaires. Preoperative therapeutic objectives should include shoulder pain control, depression and/or nocturnal sleep improvement, opioid consumption adjustment, and substance abuse cessation. Postoperative objectives regarding the degree of shoulder pain reduction or improvement in functionality and/or quality of life should be established in agreement with the patient. Treatment of preoperative chronic moderate to severe shoulder pain should comprise nonpharmacologic as well as pharmacologic interventions. Follow-up of the shoulder pain levels, treatment adherence, and mental health status of these patients may be carried out by the surgical team (surgeon and anesthesiologist) together with the primary care team. Patients with very intense shoulder pain levels may be referred to a pain unit following specific protocols.

Conclusion: A preoperative management algorithm for patients with chronic moderate to severe shoulder pain who are candidates for

Institutional review board approval was not required for this consensus study.

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surgery owing to rotator cuff disease or glenohumeral osteoarthritis was defined based on a national expert consensus. Main points include comprehensive patient management starting with an objective assessment of shoulder pain and function, as well as quality of life; establishment of preoperative and postoperative therapeutic targets; prescription of individualized therapeutic interventions; and multidisciplinary patient follow-up. Implementation of these recommendations into clinical practice may result in better preoperative shoulder pain management and more successful surgical outcomes and patient satisfaction.

Level of evidence: Level V; Consensus Development Study; Delphi Approach

Keywords: Shoulder pain; rotator cuff disease; glenohumeral osteoarthritis; postoperative pain; preoperative management; orthopedic surgery

Chronic shoulder pain, which can be defined as shoulder pain for longer than 3 or 6 months,[10] is a very common condition, with a 1-year prevalence in the general population of up to 46.7%.[31] The 3 most common causes of chronic shoulder pain are rotator cuff disorders, glenohumeral osteoarthritis, and acromioclavicular joint pathology.[4,34]

When shoulder pain begins, it is usually treated with physical therapy, analgesics such as nonsteroidal anti-inflammatory drugs and steroidal drugs, and/or local anesthetic joint injections.[4,10] When these interventions fail, a surgical approach is often required.[4,10] Surgery may be the first-line treatment in cases of acute full-thickness rotator cuff tears in younger individuals or rotator cuff tears leading to significant changes in arm function.[4]

Many individuals experience persistent postoperative shoulder pain and/or lack of functional recovery,[9,14,42,43] with a neuropathic component of pain arising after surgery.[35] In fact, the presence of some preoperative factors such as pain, sleep disturbance, and anxiety and/or depression has been reported to influence surgical outcomes,[18,26,43,45] highlighting the need to define preoperative interventions to control these factors and improve postoperative outcomes in terms of pain intensity, shoulder function, and patient satisfaction.

Currently, there are no guidelines on the preoperative management of patients with chronic moderate to severe shoulder pain who are candidates for surgery owing to rotator cuff disease or glenohumeral osteoarthritis. Therefore, the initiative to improve perioperative pain in orthopedic surgery (IMPROVE) study aimed to develop recommendations for the preoperative management of these patients using a Delphi approach.

Materials and methods

Identification of problem area of research

A scientific committee, composed of 3 shoulder surgeons and 1 anesthesiologist, carried out a systematic literature review following PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) and Scottish Intercollegiate Guidelines Network (SIGN) guidelines to find out whether specific interventions to achieve preoperative shoulder pain control improved surgical outcomes. Systematic reviews, meta-analyses, randomized controlled trials, prospective cohort studies, and cross-sectional cohort studies published within the past 10 years either in English or Spanish were included. The PubMed, Embase, and Scopus databases were searched for references using search terms related to preoperative shoulder pain management and shoulder pathologies (Supplementary Table S1) from April 11, 2021, to February 28, 2023. Twenty-eight references were peer reviewed and graded by the level of evidence according to the 2011 Oxford Centre for Evidence-Based Medicine guidelines. The results of this review are being considered for publication elsewhere.

On the basis of the results of the systematic review, the scientific committee defined a Delphi questionnaire with 49 statements focusing on 5 areas in which knowledge was uncertain or incomplete and expert opinion could provide valuable guidance: assessment and diagnosis of preoperative shoulder pain (block I), preoperative shoulder function and psychosocial aspects (block II), therapeutic objectives (block III), treatment (block IV), and follow-up and referral (block V). Twenty-nine Delphi statements that were not supported by reviewed literature were defined according to the committee's experience (statement [S] 1-4 [S1-S4], S13, S14, S16, S19-S22, S26, S31, S33-S35, and S37-S49). To establish the proposed statements as recommendations, a consensus needed to be reached in accordance with the Delphi methodology.[38]

Selection of panel

Twenty-eight experienced shoulder surgeons (≥10 years of experience since residency, routine analgesia management, most surgical activity focused on shoulder) from across Spain were invited to participate in the study.

Anonymity of panelists

The Delphi questionnaire was hosted on a website accessible through a personal alphanumeric code to maintain the anonymity of the responses. On this website, the panelists could rate each statement using a Likert-like scale from 1 (''completely disagree'') to 9 (''completely agree''). Responses were grouped by tertiles, in which 1-3 indicated disagreement; 4-6, indeterminate; and 7-9, agreement (Supplementary Appendix S1).

Controlled feedback

The scientific committee met after the first round of the questionnaire to analyze and interpret the results, which were

presented as tables including each statement, corresponding median value and interquartile range (P25% to P75%), minimum and maximum values, median range, number of participants in agreement/disagreement range, and consensus status. When the results obtained were submitted to subsequent rounds, no comments about these results or statistical data were given to avoid potential bias of the panel of participants.

Iterative Delphi rounds

Statements that did not reach consensus or reached borderline consensus could be submitted to subsequent rounds, being modified (rephrased or split into 2 statements) if the committee suspected that the original wording was not clear enough.

Consensus criteria

Consensus on a statement was reached when the responses of at least two-thirds of participants (66.7%) were in the same tertile as the median value of all the reported responses for that statement.

Analysis of consensus

For statistical analysis, a descriptive analysis of all items using mean ± standard deviation, median (25th percentile to 75th percentile), and minimum and maximum values was performed. The Kolmogorov-Smirnov test was used to check for goodness of fit of the data to a normal distribution. The internal consistency of the questionnaire was measured by the Cronbach α coefficient, which can range between 0 and 1, with higher coefficients indicating higher reliability (values >0.7 are deemed acceptable, with 0.7-0.9 considered high reliability and 0.9 considered very high reliability).[41] In addition, inter-rater reliability was assessed by the intraclass correlation coefficient (r_i) (poor, <0.40; fair, 0.40-0.59; good, 0.60-0.74; and excellent, 0.75-1.0).[15] Both values were calculated for the whole questionnaire and for each block. Correlation between the 2 rounds of the questionnaire, by statements, by blocks, and for the whole questionnaire, was measured by the Spearman coefficient (r_s) (none or poor, 0-0.25; weak, 0.26-0.50; moderate to strong, 0.51-0.75; and strong to very strong, 0.76-1).[16,32] Likewise, the κ index was calculated for each block and for the whole questionnaire to estimate the qualitative agreement between the 2 rounds, taking into account the 3 response groups (1-3, 4-6, and 7-9), with $\kappa \leq 0.20$ indicating no or poor qualitative agreement; 0.21-0.40, weak agreement; 0.41-0.60, moderate agreement; 0.61-0.80, good agreement; and 0.81-1, very good agreement.[30] The level of statistical significance was considered $P < .05$, and SPSS software (version 25.0; IBM, Armonk, NY, USA) was used for our analysis.

Closing criteria

The coefficient of variation (COV) of the questionnaire was calculated for each round, along with the delta, or relative change, in the second round above the first round ([COV for second round − COV for first round]/COV for first round). When the absolute value of delta is ≤10%, there is no large variability between the rounds and, thus, there is no need for another round because no relevant changes are expected.

Results

All participants responded to the questionnaire in the first round, and 25 of 28 responded in the second round (89.3% of those invited). Baseline characteristics of the participants are shown in Table I. Respondents were representative of the diverse local clinical and management practices of the autonomous communities of Spain.

Consensus was reached on 42 statements (87.5%) in the first round. The 6 statements without consensus were resubmitted to a second round. Of the statements, 4 were rephrased (S2, S3, S31, and S43), 1 was divided into 2 different statements (S7a and S7b), and 1 remained unchanged (S11). Overall, after the second round, 46 of 49 statements (as S7 was divided into 2 statements) reached a consensus, all of them in agreement (Table II). Only S3, S7a, and S31 did not reach the pre-established consensus threshold.

The questionnaire showed high internal consistency (Cronbach $\alpha = 0.927$ [$P < .001$] in first round and Cronbach $\alpha = 0.920$ [$P < .001$] in second round) and inter-rater reliability (ICC = 0.920 [$P < .001$] in first round and ICC = 0.888 [$P < .001$] in second round). According to block, blocks I and III showed high internal consistency and blocks II, IV, and V showed moderate internal consistency (Table III).

The COV was 0.2026 ± 0.0952 in the first round and 0.1918 ± 0.0880 in the second round; thus, the absolute value of the relative COV increase was 5.3% (<10%), indicating no need for more rounds. On the basis of the consensual items, the scientific committee defined an algorithm with recommendations for the preoperative management of patients with chronic moderate to severe shoulder pain who are candidates for surgery owing to rotator cuff disease or glenohumeral osteoarthritis (Fig. 1).

Block I: assessment and diagnosis of preoperative shoulder pain

According to the panel of experts, the presence of preoperative shoulder pain is a clinically relevant factor and a predictor of postoperative shoulder pain (S5). In fact, preoperative shoulder pain intensity is believed to directly correlate with late postoperative shoulder pain (S7b). Thus, evaluation of shoulder pain intensity and characteristics, including central and peripheral sensitization (S9 and S12), should be performed by the surgeon (S2) throughout the preoperative period (S1) by using objective scales such as the visual analog scale (VAS) or verbal rating scale (VRS) (S4) or the Douleur Neuropathique 4-item (DN4) questionnaire if a neuropathic component of pain is suspected (S8). Analysis of the sensory profile (processing of sensory stimuli at the level of proprioception, as well as sensitivity to touch, pressure, temperature, vibration, and so on, by neurologic examination with instruments such as

Table I Characteristics of study participants

	First round (N = 28)	Second round (n = 25)
Age, yr	46.0 ± 9.3	45.2 ± 8.4
Male sex	23 (82.1)	21 (84)
Clinical experience since residency, yr	16.5 [10-22]	13 [10-21]
Shoulder surgical activity ≥70%	18 (64.3)	17 (68)
Patients treated with level III opioids (per WHO scale)		
25-50 patients/yr	16 (57.1)	13 (52)
51-75 patients/yr	7 (25)	7 (28)
>75 patients/yr	5 (17.9)	5 (20)
Practice type		
Public	10 (35.7)	10 (40)
Private	2 (7.1)	1 (4)
Both	16 (57.1)	14 (56)

WHO, World Health Organization.
Categorical data are expressed as number (percentage), and continuous data are expressed as mean ± SD or median [interquartile range].

quantitative sensory testing [QST]) can also be helpful to develop tailored therapy programs (S13).

Block II: assessment of shoulder function and psychosocial aspects

There was consensus on the importance of assessing patient's psychosocial factors, shoulder function, and quality of life (QoL) prior to surgery by using specific scales to be able to evaluate surgical outcomes (S14-S18).

Block III: therapeutic objectives for preoperative shoulder pain

The panel agreed that achieving control of preoperative shoulder pain is clinically relevant and is a positive predictor factor for improved patient function after surgery (S21), especially in patients undergoing arthroscopic repair of the rotator cuff (S23). Therefore, preoperative therapeutic objectives should encompass shoulder pain control (S28), including treatment of the neuropathic component of pain in patients with rotator cuff tear (S32 and S34), substance abuse identification and treatment (S24), opioid consumption adjustment (S22), and depression and/or nocturnal sleep improvement (S26 and S27).

Postoperative therapeutic objectives should include a reduction ≥50% in preoperative shoulder pain levels and/or a score <3 in the visual analogue scale (VAS) (S19) and achievement of analgesic treatment adherence (S25). The patient's expectations of the degree of shoulder pain reduction and QoL and/or function recovery (S30) after surgery should be realistic and should be established in agreement with the patient preoperatively, as they can influence surgical outcomes and patient progress after surgery (S6, S16, S20, S29, and S48).

Block IV: therapeutic options

In patients with chronic shoulder pain, consensus was achieved regarding the preoperative use of multimodal analgesia (a combination of pharmacologic treatments with varying mechanisms of action and nonpharmacologic treatments) to improve recovery and postoperative shoulder pain, reducing the consumption of opioids (S33). Gabapentinoids are recommended to initiate treatment in patients with a neuropathic component of pain (S35), but as intensity increases, prolonged-release (PR) tapentadol, as well as other multimodal opioids, should be considered as the treatment of choice (S37 and S38). A comprehensive preoperative functional rehabilitation program and physical exercise at an adequate intensity are also recommended (S39 and S40).

Block V: follow-up and referral

Follow-up of preoperative shoulder pain levels and treatment adherence may be carried out by the surgical team (surgeon and anesthesiologist) (S41) together with the primary care physician (S42). Patients with very intense shoulder pain levels may be referred to a pain unit (S43); those with severe shoulder functional limitations, to a rehabilitation unit (S45); and those with anxiety, depression, or catastrophizing, to a mental health unit (S46 and S47).

Discussion

In our understanding, this is the first study providing evidence and consensus-based recommendations for the preoperative management of patients with chronic moderate to

Table II Delphi questionnaire

	Statement	Median (P25%-P75%)	Median range	Participants in median range, n (%)	Consensus
I. Assessment and diagnosis of pain (qualitative/quantitative)					
1	It is important to monitor the intensity and characteristics of the patient's pain during all the preoperative procedures, from assessment at the practice, when surgery is indicated, to the days previous to the surgical procedure.	8.5 (7-9)	7-9	23 (82.1)	C-A
2*	Assessment of the patient's pain during the preoperative procedures is the responsibility of the whole surgical team (surgeon and anesthetist).*	7 (5-9)	7-9	15 (53.6)	NC
2	Assessment of the patient's pain during the preoperative procedures is the responsibility of the surgeon and anesthetist.	8 (7-9)	7-9	23 (92.0)	C-A
3*	Assessment of the patient's pain during the preoperative procedures requires the use of questionnaires such as the BPI or the SF-MPQ.*	6 (5-8)	4-6	11 (39.3)	NC
3	For the assessment of the patient's pain during the preoperative procedures, the use of questionnaires such as the BPI or the SF-MPQ is recommended.	7 (5-8)	7-9	15 (60.0)	NC
4	For the assessment of the patient's pain during the preoperative procedures, it is sufficient to use qualitative and quantitative scales, such as the VAS and the simple VRS.	7 (5-8)	7-9	19 (67.9)	C (lim)-A
5	Assessment of the intensity of preoperative pain is clinically relevant because it is a predictive factor of postoperative pain.	8.5 (7-9)	7-9	24 (85.7)	C-A
6	It is important to assess previous to surgery the patient's expectations for postoperative pain as they are positive predictive factors of postoperative pain.	8 (7-9)	7-9	25 (89.3)	C-A
7*	The level of preoperative chronic pain is the factor that most directly correlates with postoperative pain—both immediate and late postoperative pain.*	6 (5-8)	4-6	10 (35.7)	NC
7a	The level of preoperative chronic pain is the factor that most directly correlates with immediate postoperative pain.	7 (5-8)	7-9	13 (52.0)	NC
7b	The level of preoperative chronic pain is the factor that most directly correlates with late postoperative pain.	8 (6-8)	7-9	18 (72.0)	C-A
8	In patients with rotator cuff tears, neuropathic pain may arise, which is associated with tobacco consumption and larger and retracted tears, and thus, it is important to assess these patients precisely during the preoperative procedures with adequate questionnaires, such as the DN4 questionnaire.	7 (6-8)	7-9	19 (67.9)	C (lim)-A
9	Patients with chronic pain (3 mo of evolution) are susceptible to the development of central and peripheral sensitization, and thus, it is important to assess these patients precisely regarding sensitization during the preoperative procedures.	8 (6-9)	7-9	21 (75.0)	C-A
10	In patients undergoing shoulder arthroplasty, greater pain sensitivity and presence of pain at rest before surgery are predictive factors of worse postoperative pain.	7 (6-8)	7-9	19 (67.9)	C (lim)-A
11*	In patients undergoing shoulder arthroplasty, greater pain sensitivity and presence of pain at rest before	7 (6-8) 8 (7-8.5)	7-9 7-9	18 (64.3) 20 (80.0)	NC (lim) C-A

(*continued on next page*)

Table II Delphi questionnaire (*continued*)

	Statement	Median (P25%-P75%)	Median range	Participants in median range, n (%)	Consensus
	surgery are predictive factors of worse postoperative function.*				
12	Addressing, prior to surgery, central pain processing pathways, which might be predictive of postoperative results, is an objective in patients with chronic shoulder pain.	8 (7-9)	7-9	23 (82.1)	C-A
13	The analysis of the sensory profile† of patients undergoing shoulder surgery may be helpful to develop plans for individualized therapy.	7 (6-9)	7-9	20 (71.4)	C-A
II. Assessment of function and psychosocial aspects					
14	It is important to use specific functional scales (ASES, CMS, QuickDASH) to assess the results of the surgical procedure.	9 (7-9)	7-9	23 (82.1)	C-A
15	It is important to assess the psychosocial factors and the QoL of the patient previous to surgery by means of QoL scales‡ to assess the results of the surgical procedure.	8 (7-9)	7-9	24 (85.7)	C-A
16	It is important to assess the patient's expectations and the presence of catastrophizing before surgery owing to their potential impact on the surgical procedure's results.	9 (8-9)	7-9	26 (92.9)	C-A
17	Anxiety and depression are predictive factors for a poor evolution of postoperative pain, and thus, they should be assessed before surgery.	9 (8-9)	7-9	26 (92.9)	C-A
18	Preoperative substance abuse (alcohol, tobacco, and drugs) is a predictive factor for a poor evolution of postoperative pain, and thus, it should be evaluated before surgery.	9 (7-9)	7-9	24 (85.7)	C-A
III. Therapeutic objectives					
19	In patients in whom shoulder surgery has been indicated, reducing the levels of presurgical pain at least 50% and/or maintaining them with a VAS score <3 is a therapeutic objective.	8 (7-9)	7-9	23 (82.1)	C-A
20	It is more important to achieve the objectives of pain control agreed on with the patient than to achieve the values recommended in clinical guidelines (pain reduction of 30%).	8 (7-9)	7-9	24 (85.7)	C-A
21	Controlling preoperative pain is a predictive factor for a good postoperative function response.	8 (7-9)	7-9	23 (82.1)	C-A
22	Adjusting the consumption of opioids is an objective of the treatment previous to shoulder surgery in patients with refractory chronic pain.	8 (7-9)	7-9	22 (78.6)	C-A
23	Controlling preoperative pain is clinically relevant in patients undergoing arthroscopic rotator cuff repair because it has an effect on short- and long-term postoperative pain.	8 (7-9)	7-9	22 (78.6)	C-A
24	A therapeutic objective previous to shoulder surgery is to improve presurgical pain control, to identify and treat a possible history of alcohol or drug use, and to provide an active placebo because all are predictors of poor analgesic and functional results.	8 (6-9)	7-9	20 (71.4)	C-A
25	A therapeutic objective previous to shoulder surgery is to improve adherence to the postoperative analgesic treatment, which is low with respect to other types	7 (6-9)	7-9	20 (71.4)	C-A

(*continued on next page*)

Table II Delphi questionnaire (*continued*)

	Statement	Median (P25%-P75%)	Median range	Participants in median range, n (%)	Consensus
	of surgery and influences the results in terms of pain relief, pain duration, and impact on QoL.				
26	Improving the patient's depressive state is a therapeutic objective previous to surgery in patients with refractory chronic shoulder pain.	8 (6-9)	7-9	21 (75.0)	C-A
27	Improving nocturnal sleep is an objective in the treatment of patients with intense chronic shoulder pain who are going to undergo surgery.	8.5 (7-9)	7-9	24 (85.7)	C-A
28	Controlling pain is an objective in the preoperative treatment because it predicts the evolution of postoperative pain.	8 (7-9)	7-9	22 (78.6)	C-A
29	Adjusting the patient's expectations on his or her postoperative pain is an objective of the preoperative treatment because it predicts the evolution of postoperative pain.	8 (7-9)	7-9	25 (89.3)	C-A
30	Presurgically establishing criteria for QoL and functionality are therapeutic objectives in shoulder surgery.	8 (7-9)	7-9	24 (85.7)	C-A
31*	In patients with preoperative intense chronic pain, delaying surgery should be considered until the pain intensity is controlled.*	4 (2-6)	4-6	10 (35.7)	NC
31	In patients with preoperative intense chronic pain, delaying surgery should be considered until the pain intensity is decreased.	6 (3-7)	4-6	7 (28.0)	NC
32	Identifying and treating the neuropathic component of pain in patients with rotator cuff tear is an objective of preoperative treatment.	8 (7-9)	7-9	22(78.6)	C-A
IV. Therapeutic options					
33	In patients with chronic pain, preoperative use of multimodal analgesia§ improves the quality of recuperation and the postoperative pain, reducing the consumption of opioids after surgery.	8 (8-9)	7-9	24 (85.7)	C-A
34	In patients with chronic pain with a neuropathic component, effective preoperative therapies for this type of pain should be initiated.	8 (8-9)	7-9	26 (92.9)	C-A
35	In patients with chronic pain with a neuropathic component, preoperative treatment with gabapentinoids should be initiated.	7 (6-8)	7-9	21 (75.0)	C-A
36	PR tapentadol may be considered as a first-line option for managing intense chronic pain with a neuropathic component.	8 (7-9)	7-9	24 (85.7)	C-A
37	In intense predominantly neuropathic chronic pain, it is preferred to use preoperative multimodal potent opioids instead of classic potent opioids because they will present better analgesia and tolerability.	8 (7-9)	7-9	24 (85.7)	C-A
38	Continuous practice of mild physical exercise, adapted to the patient's limitations, is recommended in the preoperative period of shoulder surgery.	9 (8-9)	7-9	26 (92.9)	C-A
39	A preoperative comprehensive functional rehabilitation program is recommended with the objective of improving the disability associated with pain, catastrophizing, pain intensity, pain interference with daily life activities, and psychological stress.	9 (8-9)	7-9	27 (96.4)	C-A

(*continued on next page*)

Table II Delphi questionnaire (*continued*)

	Statement	Median (P25%-P75%)	Median range	Participants in median range, n (%)	Consensus
V. Follow-up and referral					
40	It is the responsibility of the surgical team (surgeon and anesthetist) to assess the level of pain, to define the preoperative analgesic dosage and schedule, assess adherence to treatment.	8 (6-9)	7-9	19 (67.9)	C (lim)–A
41	It is important that the preoperative follow-up of pain levels is shared between the surgeon and the primary care team.	9 (7-9)	7-9	24 (85.7)	C-A
42	In patients in whom preoperative circumstances lead to the thought that the levels of postoperative pain will be more intense, it is important that the preoperative follow-up of pain be more rigorous, and it may require the participation of a pain unit.	8 (7-9)	7-9	24 (85.7)	C-A
43*	Patients with inadequate control of preoperative pain despite conventional analgesic treatment must be referred to a pain unit.*	7 (5-8)	7-9	18 (64.3)	NC (lim)
43	Patients with preoperative intense chronic pain that is not controlled with conventional analgesic treatment must be referred to a pain unit.	8 (6.5-8)	7-9	19 (76.0)	C-A
44	In patients with chronic pain and intense functional limitation, referral to a rehabilitation unit should be considered previous to surgery.	8 (7-9)	7-9	22(78.6)	C-A
45	In patients with suspected major psychiatric pathology, referral to a mental health unit should be considered previous to surgery for assessment and follow-up.	9 (9-9)	7-9	27 (96.4)	C-A
46	It is important to follow-up catastrophizing, anxiety, and depression, previous to surgery, as predictors of worse postoperative control.	9 (7-9)	7-9	24 (85.7)	C-A
47	Patient follow-up and adjustment of expectations on postoperative pain and disability previous to surgery improves surgery outcomes.	8 (8-9)	7-9	26 (92.9)	C-A
48	It is important to follow-up pain-associated disability, pain interference with daily life activities, and psychological stress to improve the pain and functional ability of patients.	9 (8-9)	7-9	26 (92.9)	C-A

C, consensus; *A*, agreement; *NC*, no consensus; *BPI*, Brief Pain Inventory; *SF-MPQ*, Short-Form McGill Pain Questionnaire; *VAS*, visual analog scale; *VRS*, verbal rating scale; *DN4*, Douleur Neuropathique 4 items; *lim*, limit; *ASES*, American Shoulder and Elbow Surgeons standardized shoulder assessment form; *CMS*, Constant-Murley score; *QuickDASH*, short version of Disabilities of the Arm, Shoulder and Hand questionnaire; *QoL*, quality of life; *PR*, prolonged release.

* Statement did not reach consensus in first round of Delphi study and was included in second round.

† Processing of sensory stimuli performed by a person, in this case at the level of proprioception, as well as sensitivity to touch, pressure, temperature, vibration, and so on, by means of neurologic exploration or with tools such as quantitative sensory testing.

‡ EQ-5D, 12-Item Short Form Survey (SF-12), and 36-Item Short Form Survey (SF-36).

§ Combination of pharmacologic treatments with different mechanisms of action and nonpharmacologic treatments.

severe shoulder pain to improve shoulder surgical outcomes in terms of pain, function, and patient satisfaction during the postoperative period. Recommendations were issued mainly based on the evidence identified through a systematic review and approved by consensus by a panel of experienced shoulder surgeons following the Delphi methodology.

Block I: assessment and diagnosis of preoperative shoulder pain

Preoperative shoulder pain intensity is a strong predictive factor for postoperative shoulder pain and level of function.[18,26,43] Notwithstanding, the panel of surgeons reached a consensus on the statement that the intensity of

Table III Internal consistency and inter-rater reliability of Delphi questionnaire

Block (no. of statements in rounds 1 and 2)	Round 1		Round 2	
	Cronbach α (*P* value)	ICC (*P* value)	Cronbach α (*P* value)	ICC (*P* value)
Total (48 and 49)	0.927 (<.001)	0.907 (<.001)	0.920 (<.001)	0.888 (<.001)
Block I (13 and 14)	0.789 (<.001)	0.723 (<.001)	0.828 (<.001)	0.755 (<.001)
Block II (5)	0.660 (<.001)	0.579 (<.001)	0.660 (.001)	0.579 (.001)
Block III (14)	0.869 (<.001)	0.818 (<.001)	0.846 (<.001)	0.781 (<.001)
Block IV (7)	0.618 (<.001)	0.582 (<.001)	0.618 (<.001)	0.582 (<.001)
Block V (9)	0.670 (<.001)	0.5 (<.001)	0.634 (<.001)	0.561 (<.001)

ICC, intraclass correlation coefficient.

preoperative shoulder pain is the factor that most directly correlates with late postoperative shoulder pain but not with immediate postoperative pain (S7a and S7b). Surgeons argued that immediate postoperative pain is highly related to the surgical procedure itself, as well as to patients' expectations of the intensity of pain after surgery. In fact, it has been demonstrated that self-anticipated postoperative pain is a strong predictor of immediate postoperative pain.[18]

It has also been reported that patients with neuropathic pain due to rotator cuff tears achieve poorer surgical outcomes.[28,29] Notably, 11%-16% of patients with rotator cuff tears experience neuropathic pain caused by peripheral neural lesions that trigger peripheral sensitization, characterized by burning pain, pain at rest, and heat hyperalgesia.[29] Peripheral sensitization can progress to central sensitization, worsening even more the clinical results in patients undergoing rotator cuff surgery[6] or total shoulder arthroplasty.[27]

An appropriate assessment of each of the dimensions involved in the painful experience should be performed, preferably using standardized assessment instruments.[19] In this sense, the panel of surgeons reached consensus on the use of validated questionnaires such as the VAS or VRS to measure shoulder pain intensity and the Douleur Neuropathique 4-item (DN4) questionnaire (https://wikimsk.org/wiki/WikiMSK:Calculators/DN4) when the presence of neuropathic pain is suspected,[44] even though their use in clinical practice is low and not always feasible. In fact, no consensus was achieved regarding the use of the Brief Pain Inventory (BPI) to evaluate the severity of shoulder pain and its impact on functioning or the Short-Form McGill Pain Questionnaire (SF-MPQ) to assess both the intensity and quality of shoulder pain (S3).

Block II: assessment of shoulder function and psychosocial aspects

Preoperative shoulder function and patient QoL are also predictive of surgical outcomes.[22,23,26,43] For instance, preoperative scores on the Western Ontario Rotator Cuff Index (WORC) and the Constant-Murley test have been shown to be strong positive independent predictors of shoulder function after 2 years in patients who underwent rotator cuff repair.[26]

In addition to the preoperative assessment of the pathology itself and accompanying pain and function levels, cognitive and emotional factors should be addressed as they can influence patients' recovery. Thus, early recognition of depression, sleep disorders, substance abuse, fear-avoidance behavior, or pessimistic personality traits can be useful to stratify the preoperative risk of poor rehabilitation or surgical outcomes.[5,20,22,23,25]

Block III: therapeutic objectives for preoperative shoulder pain

Several preoperative therapeutic objectives need to be defined, including shoulder pain control, assessment of shoulder function, patients' QoL, and addressal of the accompanying psychosocial factors. Because the preoperative use of opioids has been related to higher preoperative shoulder pain intensity, worst postoperative shoulder function,[36] sleep disturbance,[5,25] and increased opioid intake,[33] the panel reached consensus on the need to adjust the consumption of these drugs before surgery.

Postoperative therapeutic objectives of surgery may include restoration of shoulder function and shoulder pain reduction. There are no recommendations on the percentage of preoperative shoulder pain reduction that should be achieved after surgery. On the basis of their own experience and data from previous studies, the panelists agreed that surgeons should aim for a relative reduction $\geq$50% and an absolute reduction $\geq$3 cm on the VAS scale after surgery.[21] Surgeons should also aim for postoperative analgesic treatment adherence by prescribing a multimodal analgesic plan, given that patients who are non-adherent show higher Numerical Rating Scale (NRS) scores and lower satisfaction with their medication than those who are fully adherent.[12]

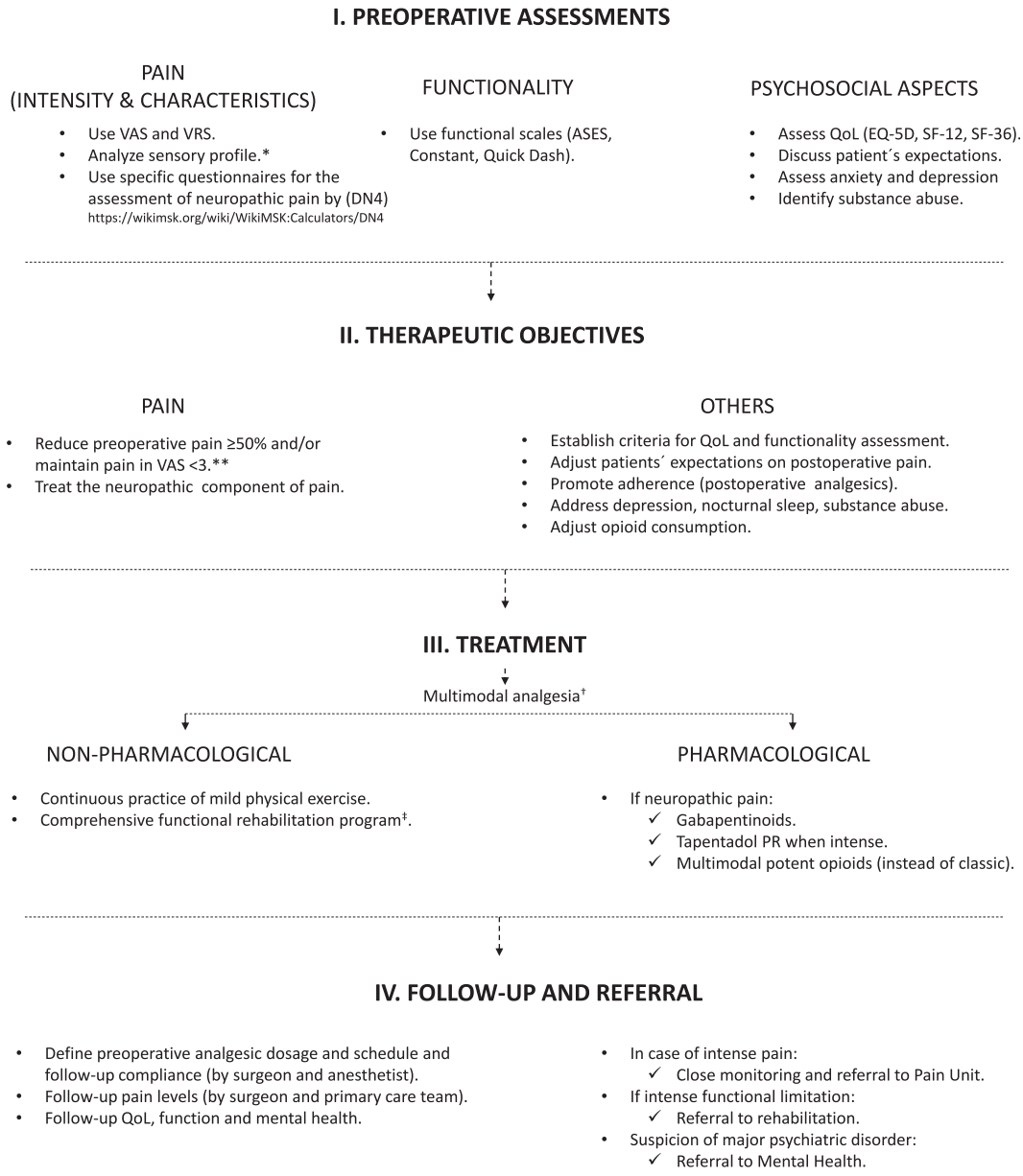

Figure 1 Proposed algorithm based on evidence and national expert consensus to improve surgical outcomes and patient satisfaction in patients with chronic moderate to severe pain who are candidates for surgery owing to rotator cuff tears or glenohumeral osteoarthritis. *Processing of sensory stimuli performed by a person, in this case at the level of proprioception, as well as sensitivity to touch, pressure, temperature, vibration, and so on, by means of neurologic exploration or with tools such as quantitative sensory testing. **Achievement of objectives of pain control agreed on with patient (rather than values recommended in guidelines). †Combination of pharmacologic treatments with different mechanisms of action and nonpharmacologic treatments. ‡Program to improve pain-associated disability, catastrophizing, pain intensity and interference with daily life activities, and psychological stress. *VAS*, visual analog scale; *VRS*, verbal rating scale; *DN4*, Douleur Neuropathique 4-item questionnaire; *ASES*, American Shoulder and Elbow Surgeons standardized shoulder assessment form; *Constant*, Constant-Murley score; *DASH*, Disabilities of the Arm, Shoulder and Hand questionnaire; *QoL*, quality of life; *SF-12*, 12-Item Short Form Survey; *SF-36*, 36-Item Short Form Survey; *PR*, prolonged release.

Block IV: therapeutic options

Preoperative shoulder pain should be treated with a multimodal analgesic approach including gabapentinoids in case of neuropathic pain, given that they have been shown to decrease shoulder pain intensity or opioid use after surgery when used perioperatively.[7,23,24] When neuropathic pain is intense, PR tapentadol is recommended for its dual mechanism of action (as a μ-opioid receptor agonist and as a norepinephrine reuptake

inhibitor) and provides strong and reliable analgesia across a range of indications, including neuropathic pain.[8,17,39,40] PR tapentadol has been used in opioid rotation in clinical trials, as well as in routine clinical practice, and it is associated with an improved tolerability profile over classic opioid analgesics.[8,17,39,40] In addition, the use of preoperative multimodal potent opioids instead of classic potent opioids is recommended when neuropathic pain is the predominant pain type.[2,37]

When long-term therapy with potent opioids is required for the treatment of non-oncologic intense chronic pain, guidelines recommend starting from low doses and gradually increasing them until an adequate level of analgesia is reached—or until adverse effects suggest a dose reduction or treatment change.[1,3] If starting with PR formulations, rescue therapy with a potent short-acting opioid should be prescribed. Among the immediate-release formulations, a minimum of 7 days is required for the dose increase (for fentanyl, it may change depending on its formulation), and among the PR formulations, such as morphine and oxycodone, it is recommended to wait 14 days (although the minimum is 2 days), whereas tapentadol can be increased after 3 days and fentanyl, after 6 days.[1]

Mild physical exercise, adapted to the patient's limitations, to improve QoL and shoulder functionality is also recommended, in addition to a comprehensive functional rehabilitation program to improve pain-associated disability, catastrophizing, pain intensity and its interference with daily life activities, and psychological stress.

Block V: follow-up and referral

Follow-up of patients with chronic moderate to severe shoulder pain who are candidates for shoulder surgery must be multidisciplinary and involve the surgeon and primary care team. In patients treated with potent opioids, a closer follow-up should be scheduled, including surveillance of potential adverse effects that may arise with their long-term use, such as neurotoxicity, hyperalgesia, and addiction,[3] and considering a dose reduction or suppression once the painful experience is under control.[11]

Study limitations

First, not all preoperative interventions are supported by high-quality evidence, and thus, a study should be conducted assessing the postoperative outcomes when some or all of those interventions are implemented. Second, not all the autonomous communities of Spain are represented in the study for logistical reasons in the selection of participants. However, the surgeons who responded to the questionnaire proved to be experts in shoulder surgery, an essential characteristic of consensus studies.[13]

Conclusion

A preoperative management algorithm for patients with chronic moderate to severe shoulder pain who are candidates for surgery owing to rotator cuff disease or glenohumeral osteoarthritis was defined based on a national expert consensus. Main points include comprehensive patient management beginning with an objective assessment of pain, QoL, and shoulder function levels; establishment of preoperative and postoperative therapeutic objectives; prescription of individualized therapeutic interventions; and multidisciplinary patient follow-up. Implementation of these recommendations into clinical practice may result in better preoperative shoulder pain management and more successful surgical outcomes and patient satisfaction.

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Supplementary Data

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References

1. Agència de Qualitat i Avaluació Sanitàries de Catalunya. Guía de atención a los pacientes con dolor crónico no oncológico utilizando analgésicos opioides. Guía de Práctica Clínica. Departament de Salut. Generalitat de Catalunya.; 2018. Available at: https://aquas.gencat.cat/web/.content/minisite/aquas/publicacions/2018/guia_atencio_pacients_dolor_opioides_vc_aquas2018ca.pdf. Accessed August 30, 2023.
2. Alcantara Montero A, Goicoechea Garcia C. [Designing safer opioids: atypical or <<multigesic>> opioids?]. Semergen 2020;46:293-6. https://doi.org/10.1016/j.semerg.2020.05.007 [Article in Spanish].
3. Álvarez Mazariegos JA, Calvete Waldomar S, Fernández-Marcote RM, Guardia Serecigni J, Henche Ruiz AI, Lligoña Garreta A, et al. Guía de consenso para el buen uso de analgésicos opioides. Gestión de riesgos y beneficios. Sociedad Científica Española de Estudios sobre el Alcohol, el Alcoholismo y las otras Toxicomanías (Socidrogalcohol); 2017. Available at: https://socidrogalcohol.org/proyecto/guia-de-consenso-para-el-buen-uso-de-analgesicos-opioides/. Accessed August 30, 2023.
4. Armstrong A. Evaluation and management of adult shoulder pain: a focus on rotator cuff disorders, acromioclavicular joint arthritis, and glenohumeral arthritis. Med Clin North Am 2014;98:755-75. xii. https://doi.org/10.1016/j.mcna.2014.03.004
5. Austin L, Pepe M, Tucker B, Ong A, Nugent R, Eck B, et al. Sleep disturbance associated with rotator cuff tear: correction with arthroscopic rotator cuff repair. Am J Sports Med 2015;43:1455-9. https://doi.org/10.1177/0363546515572769
6. Bachasson D, Singh A, Shah SB, Lane JG, Ward SR. The role of the peripheral and central nervous systems in rotator cuff disease. J Shoulder Elbow Surg 2015;24:1322-35. https://doi.org/10.1016/j.jse.2015.04.004
7. Bang SR, Yu SK, Kim TH. Can gabapentin help reduce postoperative pain in arthroscopic rotator cuff repair? A prospective, randomized, double-blind study. Arthroscopy 2010;26:S106-11. https://doi.org/10.1016/j.arthro.2009.11.010
8. Baron R, Eberhart L, Kern KU, Regner S, Rolke R, Simanski C, et al. Tapentadol prolonged release for chronic pain: a review of clinical trials and 5 years of routine clinical practice data. Pain Pract 2017;17:678-700. https://doi.org/10.1111/papr.12515
9. Bjornholdt KT, Brandsborg B, Soballe K, Nikolajsen L. Persistent pain is common 1-2 years after shoulder replacement. Acta Orthop 2015;86:71-7. https://doi.org/10.3109/17453674.2014.987065
10. Burbank KM, Stevenson JH, Czarnecki GR, Dorfman J. Chronic shoulder pain: part I. Evaluation and diagnosis. Am Fam Physician 2008;77:453-60.
11. Busse JW, Craigie S, Juurlink DN, Buckley DN, Wang L, Couban RJ, et al. Guideline for opioid therapy and chronic noncancer pain. CMAJ 2017;189:E659-66. https://doi.org/10.1503/cmaj.170363
12. Callebaut I, Jorissen S, Pelckmans C, Berends N, Droogmans M, van Rossum M, et al. Four-week pain profile and patient non-adherence to pharmacological pain therapy after day surgery. Anesth Pain Med 2020;10:e101669. https://doi.org/10.5812/aapm.101669
13. Campbell SM, Braspenning J, Hutchinson A, Marshall M. Research methods used in developing and applying quality indicators in primary care. Qual Saf Health Care 2002;11:358-64. https://doi.org/10.1136/qhc.11.4.358
14. Chang KV, Wu WT, Hung CY, Han DS, Yang RS, Chang CH, et al. Comparative effectiveness of suprascapular nerve block in the relief of acute post-operative shoulder pain: a systematic review and meta-analysis. Pain Physician 2016;19:445-56.
15. Cicchetti DV. Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instrument in psychology. Psychol Assess 1994;6:284-90.
16. Dawson B, Trapp RG. Basic & Clinical Biostatistics (LANGE Basic Science). 4th ed. New York: Lange Medical Books/McGraw- Hill; 2004.
17. Deeks ED. Tapentadol prolonged release: a review in pain management. Drugs 2018;78:1805-16. https://doi.org/10.1007/s40265-018-1007-2
18. Desai VN, Cheung EV. Postoperative pain associated with orthopedic shoulder and elbow surgery: a prospective study. J Shoulder Elbow Surg 2012;21:441-50. https://doi.org/10.1016/j.jse.2011.09.021
19. Fillingim RB, Loeser JD, Baron R, Edwards RR. Assessment of chronic pain: domains, methods, and mechanisms. J Pain 2016;17:T10-20. https://doi.org/10.1016/j.jpain.2015.08.010
20. Flanigan DC, Everhart JS, Glassman AH. Psychological factors affecting rehabilitation and outcomes following elective orthopaedic surgery. J Am Acad Orthop Surg 2015;23:563-70. https://doi.org/10.5435/JAAOS-D-14-00225
21. Forouzanfar T, Weber WE, Kemler M, van Kleef M. What is a meaningful pain reduction in patients with complex regional pain syndrome type 1? Clin J Pain 2003;19:281-5. https://doi.org/10.1097/00002508-200309000-00001
22. Gil JA, Goodman AD, Mulcahey MK. Psychological factors affecting outcomes after elective shoulder surgery. J Am Acad Orthop Surg 2018;26:e98-104. https://doi.org/10.5435/JAAOS-D-16-00827
23. Hah JM, Cramer E, Hilmoe H, Schmidt P, McCue R, Trafton J, et al. Factors associated with acute pain estimation, postoperative pain resolution, opioid cessation, and recovery: secondary analysis of a randomized clinical trial. JAMA Netw Open 2019;2:e190168. https://doi.org/10.1001/jamanetworkopen.2019.0168

24. Hah J, Mackey SC, Schmidt P, McCue R, Humphreys K, Trafton J, et al. Effect of perioperative gabapentin on postoperative pain resolution and opioid cessation in a mixed surgical cohort: a randomized clinical trial. JAMA Surg 2018;153:303-11. https://doi.org/10.1001/jamasurg.2017.4915
25. Horneff JG 3rd, Tjoumakaris F, Wowkanech C, Pepe M, Tucker B, Austin L. Long-term correction in sleep disturbance is sustained after arthroscopic rotator cuff repair. Am J Sports Med 2017;45:1670-5. https://doi.org/10.1177/0363546517692551
26. Jenssen KK, Lundgreen K, Madsen JE, Kvakestad R, Dimmen S. Prognostic factors for functional outcome after rotator cuff repair: a prospective cohort study with 2-year follow-up. Am J Sports Med 2018;46:3463-70. https://doi.org/10.1177/0363546518803331
27. Kadum B, Inngul C, Ihrman R, Sjoden GO, Sayed-Noor AS. Higher preoperative sensitivity to pain and pain at rest are associated with worse functional outcome after stemless total shoulder arthroplasty: a prospective cohort study. Bone Joint J 2018;100-B:480-4. https://doi.org/10.1302/0301-620X.100B4.BJJ-2017-1000.R1
28. Karasugi T, Ide J, Kitamura T, Okamoto N, Tokunaga T, Mizuta H. Neuropathic pain in patients with rotator cuff tears. BMC Musculoskelet Disord 2016;17:451. https://doi.org/10.1186/s12891-016-1311-5
29. Ko S, Choi C, Kim S, Chae S, Choi W, Kwon J. Prevalence and risk factors of neuropathic pain in patients with a rotator cuff tear. Pain Physician 2018;21:E173-80.
30. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics 1977;33:159-74.
31. Luime JJ, Koes BW, Hendriksen IJ, Burdorf A, Verhagen AP, Miedema HS, et al. Prevalence and incidence of shoulder pain in the general population; a systematic review. Scand J Rheumatol 2004;33:73-81. https://doi.org/10.1080/03009740310004667
32. Martínez Ortega RM, Tuya Pendás LC, Martínez Ortega M, Pérez Abreu A, Cánovas AM. [Spearman rank correlation coefficient, characterization]. Rev habanera cienc med 2009;8.
33. Martusiewicz A, Khan AZ, Chamberlain AM, Keener JD, Aleem AW. Outpatient narcotic consumption following total shoulder arthroplasty. JSES Int 2020;4:100-4. https://doi.org/10.1016/j.jses.2019.11.005
34. Meislin RJ, Sperling JW, Stitik TP. Persistent shoulder pain: epidemiology, pathophysiology, and diagnosis. Am J Orthop (Belle Mead NJ) 2005;34:5-9.
35. Miclescu A, Straatmann A, Gkatziani P, Butler S, Karlsten R, Gordh T. Chronic neuropathic pain after traumatic peripheral nerve injuries in the upper extremity: prevalence, demographic and surgical determinants, impact on health and on pain medication. Scand J Pain 2019;20:95-108. https://doi.org/10.1515/sjpain-2019-0111
36. Morris BJ, Sheth MM, Laughlin MS, Elkousy HA, Edwards TB. Risk factors for preoperative opioid use in patients undergoing primary anatomic total shoulder arthroplasty. Orthopedics 2020;43:356-60. https://doi.org/10.3928/01477447-20200721-12
37. Mugabure Bujedo B, González Santos S. New opioids with different intracellular mechanism of action; is a new therapeutic window opening up? Rev Soc Esp Dolor 2021;28:292-7. https://doi.org/10.20986/resed.2021.3891/2021
38. Nasa P, Jain R, Juneja D. Delphi methodology in healthcare research: how to decide its appropriateness. World J Methodol 2021;11:116-29. https://doi.org/10.5662/wjm.v11.i4.116
39. Romualdi P, Grilli M, Canonico PL, Collino M, Dickenson AH. Pharmacological rationale for tapentadol therapy: a review of new evidence. J Pain Res 2019;12:1513-20. https://doi.org/10.2147/JPR.S190160
40. Sanchez Del Aguila MJ, Schenk M, Kern KU, Drost T, Steigerwald I. Practical considerations for the use of tapentadol prolonged release for the management of severe chronic pain. Clin Ther 2015;37:94-113. https://doi.org/10.1016/j.clinthera.2014.07.005
41. Schmitt N. Uses and abuses of coefficient alpha. Psychol Assess 1996;8:350-3.
42. Sgroi TA, Cilenti M. Rotator cuff repair: post-operative rehabilitation concepts. Curr Rev Musculoskelet Med 2018;11:86-91. https://doi.org/10.1007/s12178-018-9462-7
43. Simon CB, Valencia C, Coronado RA, Wu SS, Li Z, Dai Y, et al. Biopsychosocial influences on shoulder pain: analyzing the temporal ordering of postoperative recovery. J Pain 2020;21:808-19. https://doi.org/10.1016/j.jpain.2019.11.008
44. Steinberg J. WikiMSK: Calculators/DN4. 2022. Available at: https://wikimsk.org/wiki/WikiMSK:About Accessed August 30, 2023.
45. Yang MMH, Hartley RL, Leung AA, Ronksley PE, Jetté N, Casha S, et al. Preoperative predictors of poor acute postoperative pain control: a systematic review and meta-analysis. BMJ Open 2019;9:e025091. https://doi.org/10.1136/bmjopen-2018-025091