



How do we assess analgesia efficacy? – a narrative review

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Background and Objective: To summarise the methods currently used to assess both acute and chronic pain and its response to treatment, and highlight certain population groups where different tools are necessary. Management of pain is an essential element of patient care, and in order to do it effectively we must be able to assess the intensity of the pain and its subsequent response to treatment. This can be difficult as pain is complex, often subjective, and has emotional and cognitive elements that also need to be identified and addressed. A number of tools have been created to allow comprehensive assessment of acute and chronic pain and its contributing factors, as well as the efficacy of any analgesic management.

Methods: A search was carried out using MEDLINE-PubMed and Google scholar looking at acute, chronic and neuropathic pain assessment, as well as cancer pain, and pain assessment in the elderly and paediatric populations. Articles written in English between 1975 and July 2021 were reviewed. Relevant validated tools and studies were identified and are summarised in this narrative overview.

Key Content and Findings: We present an outline of the key scales and assessment tools used in determining analgesia efficacy, describe their use and discuss their potential advantages and disadvantages. There are many clinical trials that review the various tools, however heterogeneity in reporting makes it difficult to reach a consensus on which to use.

Conclusions: There are a number of widely used, validated and reliable tools available for the assessment of pain intensity and its response to treatment. In acute pain these include numeric rating scales (NRS), visual analogue scales (VAS) and verbal rating scales (VRS). Chronic pain assessment involves more in-depth multi-dimensional scales such as the McGill pain questionnaire (MPQ) and brief pain inventory (BPI), functional assessment and psychological analysis. There is no consensus as to which tool is best for neuropathic pain, but there are a number available such as the Leeds assessment of neuropathic symptoms and signs (LANSS) pain scale, Douleur Neuropathique 4 questions (DN4), painDETECT and neuropathic pain score (NPS). Specific tools are available for use in more challenging population groups such as those with dementia and paediatric patients.

Keywords: Acute pain assessment; chronic pain assessment; neuropathic pain assessment

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Introduction

It is often difficult to accurately assess the severity of pain and its response to treatment, as pain is complex, multi-faceted and has a subjective element. Post-operative pain is very common, and if it is poorly controlled it can have a

negative impact on patient outcomes and increase morbidity e.g., with the development of post-operative pulmonary complications. A combination of thorough clinical assessment and the use of appropriate pain measurement tools are vital in eliciting both the intensity of pain and the response to analgesic interventions, in order to optimise

Table 1 The search strategy summary

Items	Specification
Date of search	10/09/21
Databases and other sources searched	MEDLINE-PubMed, Google Scholar
Search terms used	“Acute pain assessment”; “chronic pain” assessment, post-operative pain assessment”; “neuropathic pain assessment”; “cancer pain”; “pain assessment in dementia”; “paediatric pain assessment”; depression, anxiety and pain catastrophizing
Timeframe	2 months
Inclusion and exclusion criteria	Articles in English only
Selection process	Conducted by Dr. Parrott, content reviewed by Dr. Kelliher
Any additional considerations	None

patient experience and symptom control. There are many clinical trials that examine the various pain assessment tools, but it is difficult to find a consensus on which to use due to heterogeneity in outcome measures. Additionally the data included from the individual studies is often a hybrid of qualitative and quantitative data, requiring separate statistical analysis. We discuss the tools that we use to assess analgesia efficacy in this narrative review.

We present the following article in accordance with the Narrative Review reporting checklist (available at <https://dmr.amegroups.com/article/view/10.21037/dmr-21-93/rc>).

Methods

A search was carried out using MEDLINE-PubMed and Google Scholar looking at acute and chronic pain assessment, as well as that in elderly and paediatric populations. Search terms used were: “acute pain assessment”; “post-operative pain assessment”; “chronic pain assessment”; “neuropathic pain assessment”; “cancer pain”; “pain assessment in dementia”; and “paediatric pain assessment”. Depression, anxiety and pain catastrophizing (the tendency to ruminate on and magnify pain), were also included as they are important additional aspects in pain assessment. The literature reviewed was from between 1975 and July 2021. The articles included are mainly small prospective studies, which consist of those outlining the development of pain assessment tools as well as those critically evaluating them. However, there are also studies based on data from randomised control trials, as well as systematic reviews. As this is a narrative review article, the quality of the evidence has not been graded. See *Table 1* for a summary.

Discussion

Acute pain

Acute pain and its response to analgesia can be evaluated using a combination of clinical examination and simple assessment scales. Clinical indicators of pain include tachycardia, tachypnoea and hypertension. These are simple to measure and in addition may provide insight into both the severity of pain and the response to/efficacy of analgesia. However, an individual’s experience of pain is more complex, comprising physical and emotional elements. Assessing and treating pain requires more than simply monitoring changes in basic physical parameters and as such a number of tools have been developed. The ‘gold-standard’ is considered to be the visual analogue scale (VAS). This technique consists of a 100 mm unmarked line labelled with ‘no pain’ on the left and ‘worst pain imaginable’ on the right, on which the patient then puts a mark to indicate their level of pain. It requires some explanation to the patient as well as a level of comprehension, which limits its use in some settings such as paediatrics, learning difficulties, dementia and also in the initial post-anaesthetic period when cognition may be impaired (1). An alternative might be the numeric rating scale (NRS) which asks patients to rate their pain on an 11-point scale from 0—‘no pain’ to 10—‘worst pain’, and may be preferred due to its administration simplicity and reliability. However, both tools are straightforward to administer and are reliable, valid and sensitive to change in the measurement of severity of pain, giving an indication of response to treatment (2).

Another simple tool used to assess pain severity is the categorical verbal rating scale (VRS), which uses words such as ‘none’, ‘mild’, ‘moderate’ and ‘severe’ to describe

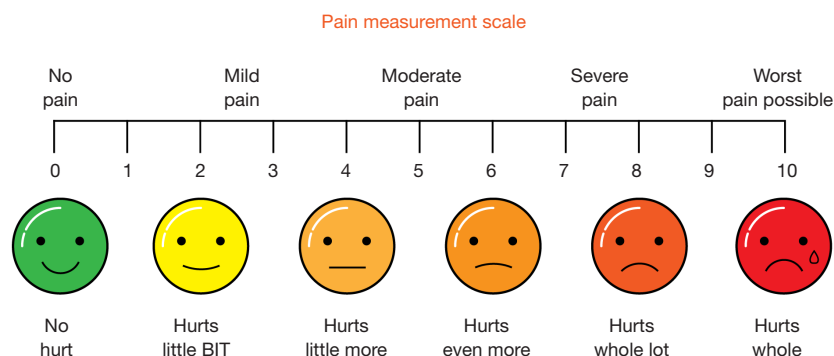


Figure 1 An example of a faces pain scale. Patients, often children, are asked to choose the face that best represents the level of “hurt” or pain they are feeling at that time, with no pain on the left up to worst pain on the right. It is meant to reflect how they are feeling inside rather than how their face appears. Shutterstock image, license obtained.

the magnitude of pain. It has high validity with respect to pain intensity, however studies have shown that it is less sensitive than both VAS and NRS (2,3). Although generally quite intuitive to use, the VRS may be limited by language barriers and be difficult to administer in those less able to communicate. VRS have been used to assess changes in both pain intensity (i.e., as measured by changes in pain intensity ratings from baseline to each post-medication assessment) and pain relief, with research indicating that these are related to but distinct from one another. This has implications for clinical trials when considering methods of assessing the impact of pain management tools and analgesia (3).

In patient populations where understanding or communication may be impaired (e.g., in paediatrics or those with dementia) it may be necessary to use alternative pain scales to evaluate acute pain. A common example is the facial pain scale (see *Figure 1*) many versions of which exist. The Faces Pain Scale-Revised (FPS-R) is one such tool; it consists of 6 gender-neutral line drawings of faces portraying increasing levels of distress, which are scored from 1–10. The patient is asked to indicate which face best represents the level of pain or “hurt” they are feeling at that time (4). Pain assessment in special circumstances is discussed in more detail below.

The majority of acute pain as assessed above tends to be somatic (due to visceral/musculoskeletal injury), however neuropathic pain (due to nerve injury/disease) has been shown to be present in the early post-operative period in up to 3% of patients (5), with a higher incidence in certain types of surgery (e.g., hernia repair). As such it is an

important consideration when managing those with acute pain as well as chronic. Methods for assessing neuropathic pain are discussed below.

Chronic pain

Chronic pain is complex, and has multiple variables and components that need to be assessed in order to build an accurate picture of the patient’s condition and the response to treatment. The unidimensional scales mentioned above are useful for rapid assessment of current pain intensity and may be used in chronic pain, however it is important to consider that the information gathered may vary depending upon the contextual details of the question. For example, what is the pain at rest *vs.* with movement, current *vs.* average, location of the pain etc. As such it may be that these scales may not represent the full picture and should be supplemented by more in-depth tools in order to provide a more accurate picture of chronic pain (6). There are various multi-dimensional scales, functional assessments and psychological tools that have been designed to accompany clinical observation in these patients.

The McGill Pain Questionnaire (MPQ) is a multi-dimensional self-rating tool that produces quantitative data regarding the subjective pain experience, allowing for statistical analysis of treatment efficacy. It consists of 3 major word descriptors for the components of pain: sensory, affective and evaluative. These subgroups, along with a miscellaneous category, have a list of words with a given ranking that the patient must choose from. The sum of the ranked scores produces the pain rating index

(PRI). The other key measures are the number of words chosen by the patient, and the Present Pain Intensity determined by a 5-point scale (1-5) (7). This tool and its less time consuming short form (SF-MPQ-2) have been widely used due to their reproducibility, reliability and validity in a diverse population of patients with chronic pain, and can be applied effectively in a number of different languages (6). However, systematic reviews suggest that further high-quality studies to assess retest reliability, cross-cultural validity and measurement error indices (e.g., standard error of measurement) are required, particularly in those with musculoskeletal conditions (8,9).

The brief pain inventory (BPI), also available as a short form (BPI-SF), is another multi-dimensional tool used in the assessment of pain severity and its impact on daily functions, as well as response to treatment. Although originally designed for patients with cancer related pain, it can be used in both chronic and acute pain conditions. It does however take 5–15 minutes to complete and as such is less desirable as a method of repeatedly reassessing response to treatment in the acute pain setting e.g., in the post-operative period. It consists of a diagram of the human form on which patients are asked to shade the affected area, plus 11 different NRS covering pain intensity (present, least, worst and average) and the effect of the pain on their ability to carry out daily activities. It has a good validity and reliability across a number of different cultures and languages, and has been adapted for use in many countries for clinical pain assessment, epidemiological studies and in studies on the effectiveness of pain treatment (10). A recent systematic review into use of the BPI-SF in patients with musculoskeletal conditions found high quality evidence for its validity and responsiveness, though as with the SF-MPQ-2 above there are insufficient reports on its cross-cultural validity and measurement error indices (9).

Functional assessment of pain involves looking into pain related disability, which has been defined as “the extent to which chronic pain interferes with a person’s ability to engage in life activities” (11). This acknowledges the complex interplay between pain intensity, extent and duration, and other factors such as emotional and cognitive responses to this pain. The Pain Disability Index was developed to allow assessment of general and specific aspects of this disability across seven different activities. These are assessed using an 11-point NRS and a general score is generated by the summation of these results. Areas identified include family/home responsibilities, recreation,

social activity, occupation, sexual behaviour, self-care, and life support activity. It has been used in clinical and research settings and has good validity, though may have only modest reliability, and as such should be used in conjunction with other physical, systematic and psychological assessments (12).

There are other tools in use that look at specific chronic pain conditions, such as the Rowland-Morris disability questionnaire (RDQ) and the Oswestry disability index (ODI), which assess lower back pain. The ODI is one of the most commonly used tools Internationally. It asks patients to rate their level of disability (0—lack of disability to 5—severe disability) in relation to 10 areas associated with lower back pain, including pain intensity, ability to walk/stand/sit, sleep quality and sexual function. It is a reliable tool that has been widely used in a range of conditions causing lower back pain, particularly lumbar spine stenosis. The RDQ is quick, simple and easy to administer, it asks patients to indicate which of 24 statements concerning physical functions apply to them that day as a result of their lower back pain, giving a score between 0 (no disability) and 24 (maximal disability). It has good scientific validity for use in lower back pain, is used in 12 different languages and a study found that there were fewer reports of ambiguity/incomplete responses when compared to the ODI (13).

Functional pain scores have also been developed for other conditions associated with chronic pain, such as the Majeed pelvic score (MPS) for pelvic fractures. It consists of five subscales including pain, work, sitting, sexual intercourse and standing (sub-divided into walking aids, unaided gait, and walking distance). These are graded by the patient to give a score from 0 to 100 (clinical grade: poor <55, fair 55–69, good 70–84, excellent ≥85), where higher scores represent the best outcomes (14). Although widely used to assess patient function following pelvic fractures, a recent Systematic Review observed poor accuracy and notable inconsistency in the use and reporting of the MPS in the literature. They indicated that interpretation and comparison of research reporting this score should be done cautiously, and that future studies should include detailed accounts of how it has been calculated to allow for verification of presented results and conclusions (15).

Special circumstances

Neuropathic pain

Neuropathic pain is a disease of the central and/or

peripheral somatosensory nervous system that can be resistant to treatment and have a significant impact on quality of life. It requires specific diagnostic skills and treatment. As such specialised tools are desirable as they can distinguish between non-neuropathic and neuropathic elements of pain. There is no consensus on which tool to use, but some of those most frequently employed include: Leeds assessment of neuropathic symptoms and signs (LANSS) pain scale, Douleur Neuropathique 4 questions (DN4), painDETECT and neuropathic pain score (NPS). The LANSS pain scale is based on analysis of sensory description and examination of sensory dysfunction (allodynia and a pinprick test), with a score of 12 or more out of 24 indicating a neuropathic cause for the pain. It can be used as a screening tool, but is also sensitive to treatment effect (16). The DN4 is a 10-item clinician-administered questionnaire consisting of sensory descriptors and physical signs, designed to distinguish between neuropathic and non-neuropathic pain. It was developed based on a patient study of those with definite somatic or neural lesions, and has a similar sensitivity and specificity to LANSS (17). The painDETECT scale was a questionnaire originally developed to distinguish between neuropathic and mechanical causes of lower back pain. It was validated in Germany, and found to have a high sensitivity, specificity and positive predictive value (18). It has been used to assess for neuropathic pain in a wide range of conditions including following total knee arthroscopy and in post-operative patients with head and neck cancer (19,20). The NPS measures neuropathic pain severity based on patient reported intensity of 11 descriptors, including how “sharp”, “hot”, “itchy” or “unpleasant” the pain is. It has been shown to have sensitivity to treatment effect (21).

Cancer pain

Pain is one of many symptoms in patients with cancer, and can be assessed using the scales above. However, a more in-depth picture of the patients' condition can be analysed using the Memorial Symptom Assessment Scale (MSAS) and its short form (MSAS-SF), which look at other symptoms and common disabilities in palliative care. It is validated for use in cancer patients, and is a multidimensional symptom assessment instrument that captures patient rated severity, frequency, and distress associated with 32 highly prevalent symptoms. It has been used in studies of patients with ovarian carcinoma, breast

carcinoma, head and neck carcinoma, and cancer pain. The short form was developed to make patient self-reporting more straightforward and less time consuming to complete. The subscales of the MSAS-SF include the Global Distress Index, the Physical Symptom Distress Score and the Psychologic Symptom Distress Score. Patients are asked to determine the frequency with which they are experiencing any symptoms over a 7-day period. The MSAS-SF has been validated against other scales used to assess functional status (Karnofsky performance status) and quality of life [Functional Assessment of Cancer Therapy-General (FACT-G)] in those with cancer (22).

Elderly

The incidence of chronic pain is significant in the elderly population, particularly among care home residents. NRS or facial pain scales have been used effectively in these patients. However, those with dementia present a more complex challenge, as they may not have the ability to self-report. In these cases it may be necessary to observe pain behaviours or facial expression. An example is the mobilisation-observation-behaviour-intensity-dementia-2 (MOBID-2) pain scale, which is a staff-administered tool for dementia patients that has been found to be sensitive to a decrease in pain intensity after pain treatment over time (23). It is conducted in two parts. In Part 1, carers assess musculoskeletal pain by observing pain behaviour during five standardised movements of different body parts, and then rate the pain intensity. This may reveal pain previously masked by the patient avoiding movement. In Part 2, pain originating from internal organs, the head and the skin is recorded by carers based on pain behaviours monitored over time, localization of pain on pain drawings and inferred pain intensity (24).

Paediatric

Assessment of pain can be even more difficult in the paediatric population, particularly in neonates, pre-verbal children or those with severe handicap. In these situations and in children under the age of 3 where self-reporting is less reliable, the most commonly used alternative is an observational pain scale. The PedIMMPACT recommendations for pain assessment tools include the FLACC (face, legs, arms, cry, consolability) scale for procedural or post-operative pain, the COMFORT scale for those on critical care, and the PPM (parents postoperative

pain measure) for pain assessment at home. The FLACC scale is one of the most widely used, with extensive reliability and validity data available. The rater gives each of the 5 variables a score of 0–2, to give a total overall score of 0–10. The COMFORT Scale measures alertness, calmness/agitation, respiration, physical movement, blood pressure change, heart rate change, muscle tone, and facial tension. Extensive validity data are available for the COMFORT Scale (4).

Self-report scales can be used in slightly older children. The PedIMMPACT recommendations for these include the Poker-Chip Tool or “pieces of hurt” for those aged 3–4 years, the faces pain scale-revised (FPS-R) for those 4–12 years and VAS for those over 8 years old. The poker-chip tool asks children to say how many “pieces of hurt” they have right now, with one chip indicating “a little hurt” and 4 indicating “most hurt you could ever have”. At present VAS scores are used in preference to NRS, as there is insufficient data on NRS in the paediatric population. This is a potential area for future research (4).

Psychological factors

When assessing the effectiveness of analgesic treatment, it is important to consider compounding variables that may be affecting the patients pain experience. There is a well-documented relationship between pain and mood, which suggests that mood and emotions can influence pain conceptualisation, intensity and response to treatment. Instruments have been developed to assess depressed mood, mood disturbance and symptoms of emotional distress in chronic pain patients, such as the Beck depression inventory (BDI) and the profile of mood states (POMS), which have been recommended for use in chronic pain clinical trials (6). Catastrophizing, the tendency to ruminate and magnify pain, along with depression is a risk factor for a number of adverse long-term pain-related outcomes such as: physical disability; increased severity of pain; enhanced pain sensitivity and poor treatment outcomes,

particularly in chronic rheumatic conditions (25). The Pain Catastrophizing scale describes different thoughts or feelings associated with pain, and a high score (greater than 30 out of 52) indicates significant catastrophizing, which is a risk factor for severe post-operative pain and development of chronicity (26). A study analysing the influence of preoperative psychological factors on postoperative pain and dysfunction following total knee arthroplasty, found that pain catastrophizing was a unique predictor of postoperative pain severity at 6 weeks. This suggests that interventions targeted to managing pain-related psychological risk factors might improve post-surgical pain (27). There has been extensive research into pain and biopsychosocial factors, however there needs to be clarification as to when to eliminate or attenuate negative emotions, and when to access, experience, and express them (28).

Summary

In order to determine how effective analgesia or a pain management plan is, it is essential to comprehensively assess pain intensity and its response to treatment. In the acute setting this can be done using clinical assessment and various pain rating scales including the VAS, NRS, VRS and FPS-R, with VAS and NRS having the greatest validity. Chronic pain can be more complex, and as such the tools used to assess it must reflect this. Options include in-depth multi-dimensional scales such as the MPQ and BPI, functional assessment such as the Pain Disability Index, and psychological analysis reviewing mood and coping ability. There is no consensus as to which tool is best for neuropathic pain, but options include the LANSS pain scale, DN4, painDETECT and NPS. Specific tools are available for use in more challenging population groups such as those with dementia (MOBID-2) and paediatric patients (FLACC, COMFORT, Poker-chip tool). See *Table 2* for a summary of the assessment tools discussed in this article.

Table 2 Summary of assessment tools and their use

Pain assessment tool	Measurement	Summary of use
VAS	Acute pain, post-operative pain	100 mm line: no pain to worst pain imaginable
NRS	Acute pain, post-operative pain, paediatric patients (over 4 years)	0–10 (no pain to worst pain)
VRS	Acute pain, post-operative pain	No pain, mild, moderate, severe
Faces pain scale, e.g., FPS-R, Wong Baker FACES pain scale	Paediatric pain	Variations on line drawings of faces showing increasing levels of distress
MPQ-SF	Chronic pain	Sensory, affective and evaluative words which patients must rate and create PRI + present pain intensity rating
BPI	Chronic pain	Diagram to indicate site of pain + 11 point NRS + impact of pain on functions of daily living
Pain disability index	Chronic & pain related disability	11 point NRS used to assess pain and disability across 7 different activities
Rowland-Morris questionnaire	Chronic lower back pain	24 statements of physical function that patients are asked to indicate affect them
ODI	Chronic lower back pain	Patients rate their disability in 10 areas associated with lower back pain
MPS	Pelvic fracture outcomes (functional)	5 subscales: pain; work; sitting; sexual intercourse and standing (sub-divided into walking aids, unaided gait, and walking distance). These are graded by the patient to give a score from 0 to 100 (graded: poor <55, fair 55–69, good 70–84, excellent ≥85), where higher scores represent the best outcomes
MSAS-SF	Cancer pain	Patient rated severity, frequency, and distress associated with 32 highly prevalent symptoms related to cancer; global distress index + physical symptom distress score + psychologic symptom distress score
MOBID-2 pain scale	Elderly patients with dementia	Part 1: carers observe pain behaviour during five movements of different body parts, and then rate the pain intensity Part 2: pain originating from internal organs, the head and the skin is recorded by carers based on pain behaviours monitored over time, localization of pain on pain drawings and inferred pain intensity
FLACC scale	Paediatric, usually post procedure/operation	The 5 variables are given a score of 0–2, to give a total overall score of 0–10
COMFORT	Paediatric, usually in intensive care	Measures alertness, calmness/agitation, respiration, physical movement, blood pressure change, heart rate change, muscle tone, and facial tension
Poker-chip tool	Paediatric	Children say how many “pieces of hurt” they have right now, with one chip indicating “a little hurt” and 4 indicating “most hurt you could ever have”

VAS, visual analogue scale; NRS, numeric rating scale; VRS, verbal rating scale; FPS-R, faces pain scale-revised; MPQ-SF, McGill pain questionnaire & short form; PRI, pain rating index; BPI, brief pain inventory; ODI, Oswestry disability index; MPS, Majeed pelvic score; MSAS-SF, memorial symptom assessment scale and its short form; MOBID-2, mobilisation-observation-behaviour-intensity-dementia-2; FLACC, face, legs, arms, cry, consolability.

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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