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Assessment of pain

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Valid and reliable assessment of pain is essential for both clinical trials and effective pain management. The nature of pain makes objective measurement impossible. Acute pain can be reliably assessed, both at rest (important for comfort) and during movement (important for function and risk of postoperative complications), with one-dimensional tools such as numeric rating scales or visual analogue scales. Both these are more powerful in detecting changes in pain intensity than a verbal categorical rating scale. In acute pain trials, assessment of baseline pain must ensure sufficient pain intensity for the trial to detect meaningful treatment effects. Chronic pain assessment and its impact on physical, emotional, and social functions require multidimensional qualitative tools and health-related quality of life instruments. Several disease- and patient-specific functional scales are useful, such as the Western Ontario and MacMaster Universities for osteoarthritis, and several neuropathic pain screening tools. The Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials recommendations for outcome measurements of chronic pain trials are also useful for routine assessment. Cancer pain assessment is complicated by a number of other bodily and mental symptoms such as fatigue and depression, all affecting quality of life. It is noteworthy that quality of life reported by chronic pain patients can be as much affected as that of terminal cancer patients. Any assessment of pain must take into account other factors, such as cognitive impairment or dementia, and assessment tools validated in the specific patient groups being studied.

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Assessment of pain can be a simple and straightforward task when dealing with acute pain and pain as a symptom of trauma or disease. Assessment of location and intensity of pain often suffices in clinical practice. However, other important aspects of acute pain, in addition to pain intensity at rest, need to be defined and measured when clinical trials of acute pain treatment are planned. If not, meaningless data and false conclusions may result. Assessment of long-lasting pain and the effects of treatment is more challenging, both in patients suffering pain from non-malignant causes and in patients with cancer pain. Numerous instruments have been developed for different types and subtypes of chronic pain conditions in order to assess qualitative aspects of chronic pain and its impact on function. The long list of published instruments indicates that pain assessment continues to be a challenge. Because pain is such a subjective, personal, and private experience, assessing pain in patients with whom we cannot communicate well is difficult, most of all in patients suffering cognitive impairment and dementia.

Assessment of pain intensity and pain relief in acute pain

For acute pain, caused by trauma, surgery, childbirth, or an acute medical disease, determining location, temporal aspects, and pain intensity, goes a long way to characterize the pain and evaluate the effects of treatment of the pain condition and its underlying cause.

Assessment of intensity of acute pain

The well-known visual analogue scale (VAS) and numeric rating scale (NRS) for assessment of pain intensity agree well and are equally sensitive in assessing acute pain after surgery, and they are both superior to a four-point verbal categorical rating scale (VRS). They function best for the patient's subjective feeling of the intensity of pain right now—present pain intensity. They may be used for worst, least, or average pain over the last 24 h, or during the last week. There are some limitations with this, as memory of pain is not accurate and often coloured by changing

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context factors. They are also used to assess 'unpleasantness' of pain and to grade impact of pain on function. The indicated ranges of the categories of the VRS scale on the NRS are approximate, with significant variation both between patients and in individuals at different time points (Figs 1 and 2):[10] a study using simultaneous recordings of pain intensity on VAS, NRS, and VRS scales in a large number of patients demonstrated the superiority of the VAS and NRS over VRS. A computerized simulation study, randomly sampling 10 000 times, repeatedly from simultaneous observations of VAS, NRS, and VRS, documented that the power to detect a difference in pain intensity was higher with the NRS and the VAS data compared with the VRS data.[10] The power to detect a difference in pain intensity was shown to be higher with a large difference. This also means that if baseline pain is high before pain relief is initiated, an effective treatment will be able to cause a larger change in pain intensity than a less effective treatment. The power of a trial to detect a large difference is high, compared with a trial where the baseline pain intensity is low and even a very effective treatment will cause only a small change in pain intensity (Fig. 2).[10] When comparing a simple, weak analgesic with a potent analgesic drug in patients with only mild baseline pain, they will both relieve the mild pain and appear to be equally effective.

The verbal categories mild, moderate, and severe pain may correspond to different values on the VAS in the same patient on different occasions, whereas the NRS and VAS values generally agreed well.[10] Thus, a categorical pain scale should be used only as a coarse screening instrument, and more accurate pain intensity assessment should rely on an NRS or VAS, even in routine clinical assessment.

An NRS with numbers from 0 to 10 ('no pain' to 'worst pain imaginable') is more practical than a VAS, easier to understand for most people, and does not need clear vision, dexterity, paper, and pen. One can even determine the intensity of pain accurately using telephone interview, a computerized telephone interview, and recording of NRS data by the patient directly into the database of a computer via the telephone keyboard. The NRS and the VAS have been shown to give almost identical values in the same patient at various times after surgery, whereas the four-point VRS seemed to underestimate the most intense pain compared with the VAS.[10]

For younger children, from about 3 yr, pain scales with happy and unhappy faces are well validated, for example, the faces pain scale (Fig. 3).[25]

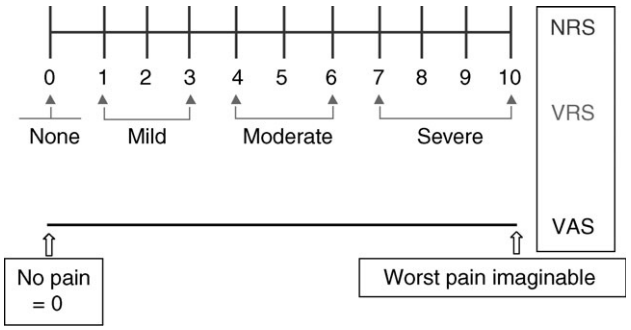

Fig 1 Commonly used one-dimensional pain intensity scales: the 11-point NRS, the VAS from no pain (=0) to worst pain imaginable [=10 (or 100)] and the four-point categorical verbal rating scale (VRS).

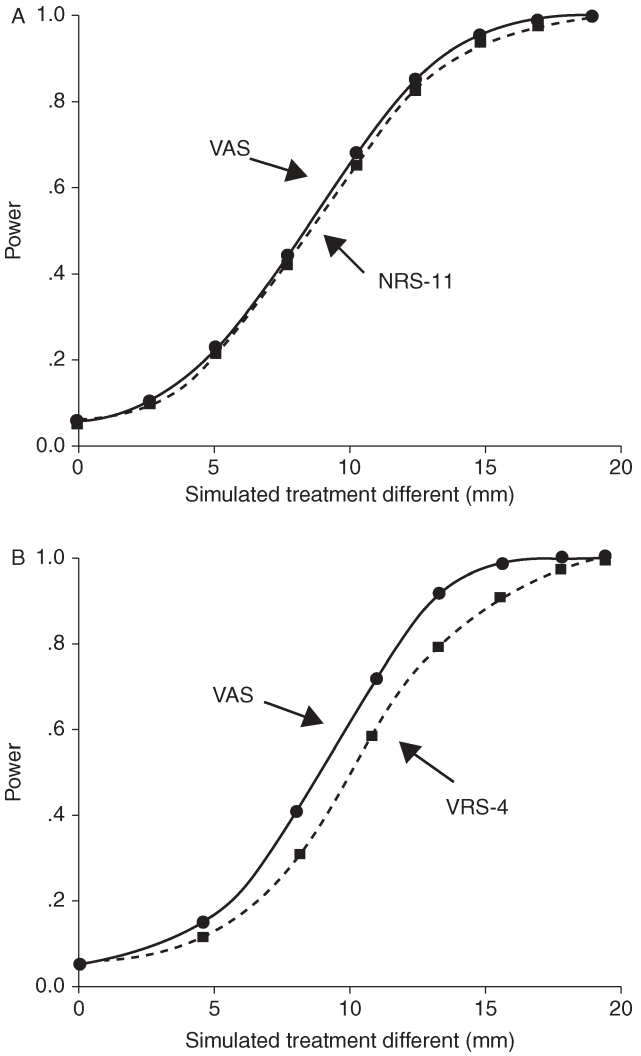

Fig 2 (A) The power to detect a difference in pain intensity observed with the VAS compared with simultaneously observed NRS values. Results from computer simulation of samples of 10 000 from simultaneously observed NRS and VAS pain intensity scores. The power to detect a difference increases with the magnitude of the difference in pain intensities before and after pain treatment.[10] (Reproduced with permission.) Differences less than about 15 (on a 0–100 VAS) or 1.5 (on a 0–10 NRS) are also clinically less meaningful.[18] (B) The power to detect a difference in pain intensity observed with the VAS is higher than with the simultaneously observed four-point categorical VRS values. Results from computer simulation of samples of 10 000 from simultaneously observed VRS and VAS pain intensity scores.[10] (Reproduced with permission.)

Assessment of acute pain during movement (dynamic pain) is more important than pain at rest

Assessment of the intensity of acute pain at rest after surgery is important for making the patient comfortable in bed. However, adequate relief of dynamic pain during mobilization, deep breathing, and coughing is more important for reducing risks of cardiopulmonary and thromboembolic complications after surgery. Immobilization is also a known risk factor for chronic hyperalgesic pain after surgery, becoming a significant health problem in about 1%, a bothersome but not negligible problem in another 10%.[47] Effective relief of dynamic pain facilitates mobilization and therefore may improve long-term outcome after surgery.[47]

Assessment of pain only at rest will not reveal differences between more potent pain relieving methods, such as optimal thoracic epidural analgesia, compared with less effective epidurals or systemic opioid analgesia: systemic opioids can make the patient comfortable, even after major surgery, when resting in bed. However, severe dynamic pain provoked by movements necessary to get the patient out of bed, and mobilizing bronchial secretions by forceful coughing, cannot be relieved by systemically administered potent opioids without causing unacceptable adverse effects.[36]

Assessment of baseline pain and assay sensitivity in analgesic trials

In trials of analgesic drugs, assessing baseline pain before including patients is necessary in order to be able to document assay sensitivity: codeine plus acetaminophen was not different from acetaminophen alone in patients with only moderate baseline pain after C-section (40–60 on a 0–100 VAS), but was clearly superior in those with more severe (above 60 on a 0–100 VAS) baseline pain.[6] An even more potent and longer-lasting additive effect between diclofenac and acetaminophen was documented in patients with a score above 50 on a 0–100 VAS after oral surgery.[9]

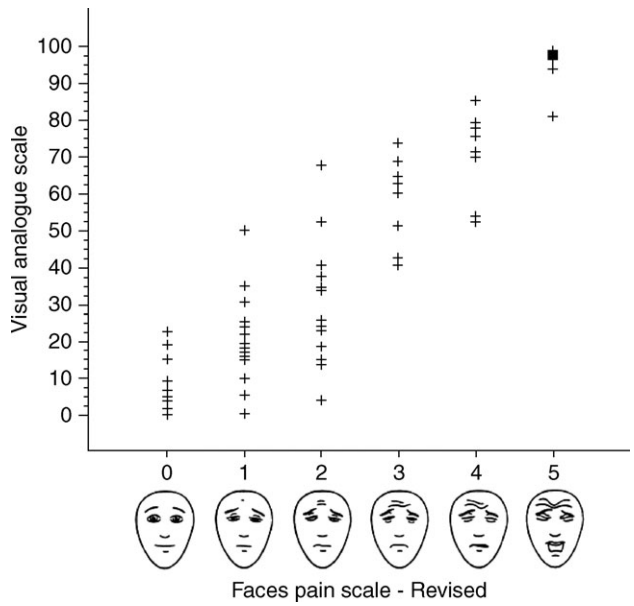

Fig 3 Agreement between simultaneously recorded pain intensity on a VAS and on a six-point faces pain scale: experimental pain: earlobe pinching in 4–12-yr-old children.[25] (Reprinted with permission from Elsevier and IASP.)

Failure to assess baseline pain caused an erroneous belief in the efficacy of intra-articular morphine as a local analgesic after knee surgery. Small doses of morphine administered into the knee at the end of the surgical procedures, with the patient still under neuraxial or general anaesthesia, appeared to cause profound and long-lasting pain relief. However, when selecting patients who had at least moderate baseline pain after knee procedures before saline with or without morphine (2 or 5 mg) had been administered intra-articularly through a catheter left in the joint at the end of the procedure,[41] morphine could not be shown to have any local analgesic effect in addition to that of saline.[39–42 45] This is in glaring contrast to a number of studies, without assessing baseline pain first, claiming a potent and long-lasting analgesic effect of small doses of morphine administered into the knee joint after such procedures.[39] The between-subject variation in postoperative pain after similar procedures is huge, and females tend to experience more pain than males.[40] If patients are given a test drug before baseline pain is assessed, the possibility that patients with naturally occurring more severe postoperative pain may be randomly allocated to the control group may lead to a false conclusion that the active drug is effective.[40] This risk of erroneous conclusion is largest when sample sizes are small, as is typical in published positive studies of intra-articular morphine analgesia: a skewed sex distribution between the groups may also explain the observed difference between the groups.[39] Publication bias towards studies with positive findings may have aggravated this phenomenon.[39]

Assessment of neuropathic components in acute pain after surgery

Recently, awareness of the changes in central nervous system pain modulating mechanisms caused by surgical trauma has increased.[47] The possibility that such central sensitization of the spinal cord may develop into chronic neuropathic pain after surgery in many patients makes it important that we assess and treat signs of central sensitization in acute pain.[38 47 49] Assessment of mechanical allodynia, with von Frey filaments, has shown that central sensitization of pain transmission mechanisms after surgery can be suppressed by low-dose ketamine, a glutamate receptor antagonist.[49] The same effect occurs with glucocorticoid administration and may be the reason for

a reduction of dysaesthetic discomfort from 60% to 30% in patients 1 yr after breast augmentation surgery when methylprednisolone was given before skin incision.[38]

Assessment of chronic pain

Chronic pain has a major impact on physical, emotional, and cognitive function, on social and family life, and on the ability to work and secure an income.[11] Meaningful assessment of long-lasting pain is therefore a more demanding task than assessing acute pain. This is true both in clinical practice and when conducting trials of management of long-lasting pain.[34 48]

A comprehensive assessment of any chronic complex pain condition requires documenting (i) pain history, (ii) physical examination, and (iii) specific diagnostic tests.

Pain history

A general medical history is an important part of the pain history, often revealing important aspects of co-morbidities contributing to a complex pain condition.

The specific pain history must clarify location, intensity, pain descriptors, temporal aspects, and possible pathophysiological and aetiological issues.

(i) Where is the pain?
(ii) How intense is the pain?
(iii) Description of the pain (e.g. burning, aching, stabbing, shooting, throbbing, etc).
(iv) How did the pain start?
(v) What is the time course of the pain?
(vi) What relieves the pain?
(vii) What aggravates the pain?
(viii) How does your pain affect
  (a) your sleep?
  (b) your physical functions?
  (c) your ability to work?
  (d) your economy?
  (e) your mood?
  (f) your family life?
  (g) your social life?
  (h) your sex life?
(ix) What treatments have you received? Effects of treatments? Any adverse effects?
(x) Are you depressed?
(xi) Are you worried about the outcome of your pain condition and your health?
(xii) Are you involved in a litigation or compensation process?

Physical examination

(i) General physical examination;
(ii) specific pain evaluation;
(iii) neurological examination;
(iv) musculoskeletal system examination;
(v) assessment of psychological factors.

Specific diagnostic studies

(i) Quantitative sensory testing (QST) with specific and well-defined sensory stimuli for pain thresholds and pain tolerance.[29 30]
(ii) 'Poor man's sensory testing': cold water in a glass tube (for cold allodynia—Aδ- and C-fibres), one glass tube with about 40°C warm water (for heat allodynia—C-fibres), cotton wool and artist's brush for dynamic mechanical allodynia, and a blunt needle for hyperalgesia and temporal summation of pain stimuli.
(iii) Diagnostic nerve blocks.[7 46]
(iv) Pharmacological tests.[3]
(v) Conventional radiography, computerized tomography, magnetic resonance imaging.

Chronic pain assessment tools

Several assessment tools are developed; the following are documented to be reliable and valid in several languages.

The Brief Pain Inventory

The Brief Pain Inventory (BPI) was developed from the Wisconsin Brief Pain Questionnaire.[16] The BPI assesses pain severity and the degree of interference with function, using 0–10 NRS. It can be self-administered, given in a clinical interview, or even administered over the telephone. Most patients can complete the short version of the BPI in 2 or 3 min. Chronic pain usually varies throughout the day and night, and therefore the BPI asks the patient to rate their present pain intensity, 'pain now', and pain 'at its worst', 'least', and 'average' over the last 24 h. Location of pain on a body chart and characteristics of the pain are documented. The BPI also asks the patient to rate how much pain interferes with seven aspects of life: (1) general activity, (2) walking, (3) normal work, (4) relations with other people, (5) mood, (6) sleep, and (7) enjoyment of life. The BPI asks the patient to rate the relief they feel from the current pain treatment.[53]

The McGill Pain Questionnaire and the short-form McGill Pain Questionnaire

The McGill Pain Questionnaire (MPQ) and the short-form MPQ (SF-MPQ) evaluate sensory, affective–emotional, evaluative, and temporal aspects of the patient's pain condition. The SF-MPQ consists of 11 sensory (sharp, shooting, etc.) and four affective (sickening, fearful, etc.) verbal descriptors. The patient is asked to rate the intensity of each descriptor on a scale from 0 to 3 (=severe). Three pain scores are calculated: the sensory, the affective, and the total pain index. Patients also rate their present pain intensity on a 0–5 scale and a VAS.[34]

The Massachusetts General Hospital Pain Center's Pain Assessment Form

The Massachusetts General Hospital Pain Center's Pain Assessment Form is another brief patient self-report form covering the essential issues needed in a self-report pain form.[32]

Neuropathic pain screening tools

The self-complete Leeds Assessment of Neuropathic Symptoms and Signs[4] and the neuropathic pain scale[27] screen for and evaluate neuropathic pain conditions. The pain quality assessment scale (PQAS) is a more generic instrument which will differentiate between more nociceptive and more neuropathic pain conditions.[5 28] Clearly, complex chronic pain conditions may have components of nociceptive, inflammatory, and neuropathic pain mechanisms.[5] Treatments may have different effects on the different pain mechanisms.[5]

The Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials

The Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) recommended six core outcome domains:[17 18]

(i) pain;
(ii) physical functioning;
(iii) emotional functioning;
(iv) patient ratings of improvement and satisfaction with treatment;
(v) other symptoms and adverse events during treatment;
(vi) patient's disposition and characteristics data.

The recommended outcome measures and instruments for these six domains, and what the IMMPACT group considers meaningful changes in the measured variables are the following.[18]

(i) *Pain intensity* rated on a 0–10 NRS and the amount of any rescue analgesics used: a 10–20% decrease in pain intensity is considered minimally important, at least 30% decrease is moderately important, and more than 50% decrease is a substantial improvement.
(ii) *Physical functioning* assessed by the BPI pain interference items: a one-point improvement is minimally important.
(iii) *Emotional functioning* assessed by Beck Depression Inventory: more than five-point decrease is clinically important. The Profile of Mood States: total mood disturbance is clinically important with a 10–15 point decrease.
(iv) *Patient ratings of improvement, or worsening*, of the pain condition by the patients' global impression of change scale: a minimally important change to the better is the patient's report of 'minimally improved', moderately important is 'much improved', and a substantial change is 'very much improved'.
(v) *Other symptoms and any adverse events* are documented by using passive capture of spontaneously reported events and open-ended prompts.
(vi) *Patient's dispositions and characteristics data* assessed in accord with the CONSORT recommendations.[1]

The IMMPACT recommendations applied to everyday clinical pain patient assessment

The IMMPACT recommendations are primarily for improving clinical trials methodology. However, it is equally important that pain clinics evaluate outcome of clinical treatment in a standardized manner. For everyday clinical practice, it is necessary to have outcome measures that are practical enough to be easily used in all patients and comprehensive enough to be useful in evaluation of patients referred to a pain clinic.

For these reasons, The Norwegian Pain Society has created a four-page, optically readable, 31 items screening questionnaire which covers the IMMPACT-recommended outcome domains, and in addition includes questions on coping and catastrophizing, health-related quality of life, economic impact of the pain condition, social security status, and any ongoing litigation or compensation process (Table 1).[22] In the follow-up consultations, patient ratings of improvement, or worsening, of the pain condition is assessed by the patient global impression of change scale. This is an instrument for minimum-requirement assessment that all pain clinics should adhere to. Each pain clinic, depending on resources and degree of complexity of management programmes offered, can add necessary additional questions and data fields. The form is available on the Internet (in Norwegian and English) at www.norsksmerteforening.no.

Table 1 Content of a four-page minimal-requirement pain assessment tool for pain clinics[22]

Domain	Instruments for measurement
Patient's characteristics	Categories from the Statistical Registry
Pain	Body chart and three NRS pain intensity at worst, least, and average last 24 h (from BPI)
Coping/catastrophizing	Two Qs from Coping Strategies Questionnaire
Health-related quality of life	Eight Qs from SF-8 Two Qs from EORTC QLQ-C30
Physical functions	10 Qs from SF-36
Emotional functions	Five Qs from SF-36 (MHI-5)
Three more pain-related Qs	Duration of pain condition Economic impact of pain condition Ongoing compensation process?
Patient rating of improvement and satisfaction with treatment	Three Qs in follow-up questionnaire

Assessment of health-related quality of life of patients in chronic pain

The importance of assessing quality of life in chronic pain patients was illustratively documented by Fredheim and colleagues.[23] Health-related quality of life was assessed in 288 patients admitted to the multidisciplinary pain centre and in 434 patients with advanced cancer admitted to the palliative care programme of the same medical centre at the University Hospital in Trondheim, Norway. They used the European Organization for Research and Treatment of Cancer EORTC- QLQ C30-quality of life questionnaire. Its reliability and validity had previously been verified and compared with the SF-36 health-related quality of life questionnaire for patients with chronic non-cancer pain.[21] Both groups of patients had substantially lower quality of life compared with a normal population. But most impressive was the finding that patients with chronic non-cancer pain reported even worse quality of life than dying cancer patients, a dramatic illustration of the major impact of chronic pain conditions on the global situation of persons with long-lasting pain.[23]

Disease-specific and generic instruments for assessing the impact of pain on function

There are a number of pain assessment instruments constructed for evaluation of pain-related functional disturbances in specific diseases or pain conditions, for example, Western Ontario and MacMaster Universities osteoarthritis index; the arthritis impact measurement scale; rheumatoid arthritis pain scale; disability of arm, shoulder and hand; patient-specific functional scale—in which the patient is asked to list five activities or tasks that they regularly performed before the onset of pain, but now find difficult to perform. These and others are described by Sokka[44] and in Wittink and Carr's source book.[54] When assessing specific conditions, it may be appropriate to use both generic and specific tools, especially in the context of clinical trials.

Assessment of cancer pain and pain in palliative care

A major leap forward in the management of cancer-related pain occurred during the years after publication of guidelines by the World Health Organization (WHO) in 1986.[55] However, recent studies document that relief of cancer pain is far from satisfactory, even in the most developed parts of the world.[37 51] The WHO estimates that the majority of the 4–5 million terminal cancer patients and 1–2 million end-stage HIV/AIDS patients globally suffer from unnecessary severe pain because essential analgesic drugs are not available, something the WHO and the International Narcotic Control Board (INCB) are now trying to change through the Access to Controlled Medications Programme (ACMP) in collaboration with the International Association for the Study of Pain (IASP) and others.[8 43] Adequate and systematic assessment of cancer pain are also prerequisites for improving pain treatment in cancer patients.[53] The BPI was originally designed to assess cancer-related pain, and is now the most commonly used cancer pain assessment instrument (see above).[16 53]

In palliative care, pain is the most important of several symptoms assessed in outcome measures. The Edmonton Symptom Assessment System assesses 9 items: pain, activity, nausea, depression, anxiety, drowsiness, appetite, well-being, and shortness of breath.[53] There are several instruments validated for assessing pain and other common symptoms and functional disabilities in palliative care:[52] Memorial Pain Assessment Card; Memorial Symptom Assessment Scale (MSAS) and a Short Form (MSAS-SF); M.D. Anderson Symptom Inventory (MDASI); the Rotterdam Symptom Checklist; and the Symptom Distress Scale.

Assessment of pain in patients with communication problems and in dementia

When the patient cannot report his/her subjective pain experience, proxy measurements of pain must be used, such as pain behaviours and reactions that may indicate that the person is suffering painful experiences. Besides communication difficulties caused by language problems, patients in the extremes of age, and critically ill patients in the intensive care setting, are common assessment problems.

The COMFORT Pain Scale for infants and small children[2]

The COMFORT scale measures distress in unconscious and ventilated infants, children, and adolescents. It relies on nine indicators: alertness; calmness or agitation; respiratory distress; crying; physical movement; muscle tone; facial tension; arterial pressure; and heart rate.

Each indicator is scored between 1 and 5 based upon the behaviours exhibited by the patient, who is observed unobtrusively for about 2 min. The sum of scores can range between 9 and 45. A score of 17–26 generally indicates adequate sedation and pain control.

Face–Legs–Activity–Cry–Consolability

This is a pain assessment tool which incorporates five categories of pain behaviours: facial expression; leg movement; activity; cry; and consolability validated for scoring postoperative pain in infants and children 2 months to 7 yr.[35]

The CRIES Pain Scale

The CRIES Pain Scale is validated for neonates, from 32 weeks of gestational age to 6 months. Each of five categories is scored from 0 to 2: crying; requires O_2 for saturation below 95%; increased vital signs (arterial pressure and heart rate); expression—facial; and sleepless.[31]

The MOBID-2 Pain Scale for assessment of pain in persons in nursing homes and patients with dementia[26]

This is a staff-administered behavioural pain assessment tool for older persons with dementia. It is based on patients' behaviour in connection with standardized active, guided movements of different body parts and pain behaviour related to internal organs, head, and skin. It is documented to be reliable, but validity is difficult to document because pain scores are indirectly observed and inferred by proxies (nurses or doctors).[26]

The same is true for other scales in persons not able to express their subjective experiences, such as the *Checklist of Nonverbal Pain Indicators*[20] and *Doloplus 2*.[33]

For more information and descriptions of pain assessment tools go to http://painconsortium.nih.gov/pain_scales/index.html and www.immpact.org.

In conclusion, adequate assessment of pain, using validated tools appropriate to the population or individual, is an essential prerequisite of successful pain management. It has been shown in many countries that inadequate pain assessment is common, with resultant failings in management of pain.[13 15 19 24 50] Only by regularly assessing and measuring pain, as routinely as the other vital signs, can we hope to make pain visible enough to those caring for patients and thus improve management.[12] This is especially true for the patients that anaesthetists care for every day, those with acute pain after surgery, trauma, and in the intensive care unit.[14]

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