# 2. ASSESSMENT AND MEASUREMENT OF PAIN AND ITS TREATMENT

## 2.1 Assessment

Reliable and accurate assessment of acute pain is necessary to ensure patients experience safe, effective and individualised pain management. The assessment and measurement of pain are fundamental to the process of assisting in the diagnosis of the cause of a patient's pain, selecting an appropriate analgesic therapy and evaluating then modifying that therapy according to a patient's response. Pain should be assessed within a biopsychosocial model that recognises that physiological, psychological and environmental factors influence the overall pain experience.

The assessment of acute pain should include a thorough general medical history and physical examination, a specific 'pain history' (see Table 2.1) and an evaluation of associated functional impairment (see Section 2.3). In acute pain management, assessment must be undertaken at appropriately frequent intervals. At these times, evaluation of pain intensity, functional impact, and side effects of treatment must be undertaken and recorded using tools and scales that are consistent, valid and reliable (Scott & McDonald, 2008). In addition, pain assessment must lead to changes in management and re-evaluation of the patient to ensure improvements in the quality of care (Gordon et al, 2005).

Although not always possible in an acute setting, a complete pain history provides important diagnostic information that may help distinguish different underlying pain states such as nociceptive (somatic and visceral) or neuropathic pain (Victor et al, 2008). Somatic pain may be described as sharp, hot or stinging, is generally well localised, and is associated with local and surrounding tenderness. By contrast, visceral pain may be described as dull, cramping, or colicky, is often poorly localised and may be associated with tenderness locally or in the area of referred pain, or with symptoms such as nausea, sweating and cardiovascular changes (Scott & McDonald, 2008).

While nociceptive pain typically predominates in the acute pain setting, patients may also experience neuropathic pain (see Section 1.3). Features in the pain history that may suggest a diagnosis of neuropathic pain include (Gray, 2008; Dworkin et al, 2007):

- clinical circumstances associated with a high risk of nerve injury eg thoracic or chest wall procedures, amputations or hernia repairs;
- pain descriptors such as burning, shooting and stabbing;
- the paroxysmal or spontaneous nature of the pain, which may have no clear precipitating factors;
- the presence of dysaesthesias (spontaneous or evoked unpleasant abnormal sensations), hyperalgesia (increased response to a normally painful stimulus), allodynia (pain due to a stimulus that does not normally evoke pain such as light touch) or areas of hypoaesthesia; and
- regional autonomic features (changes in colour, temperature and sweating) and phantom phenomena.

It is useful to draw the distinction between the different types of pain because the likely duration of the pain and the response to analgesic strategies may vary. The concept of 'mechanism-based pain diagnosis' has been promoted (Woolf & Max, 2001) and although the

correlation between symptoms, mechanisms and response to therapy is not fully defined, specific therapy targeted at, for example, neuropathic pain, may be of benefit (Gray, 2008).

**Table 2.1 Fundamentals of a pain history**

| | |
|---|---|
| **1** | **Site of pain** |
| | a primary location: description ± body map diagram |
| | b radiation |
| **2** | **Circumstances associated with pain onset** |
| | including details of trauma or surgical procedures |
| **3** | **Character of pain** |
| | a sensory descriptors eg sharp, throbbing, aching (Victor et al, 2008) |
| | b McGill Pain Questionnaire: includes sensory and affective descriptors (Melzack, 1987) |
| | c neuropathic pain characteristics (eg Neuropathic Pain Questionnaire) (Backonja & Krause, 2003) |
| **4** | **Intensity of pain** |
| | a at rest |
| | b on movement |
| | c temporal factors |
| | i duration |
| | ii current pain, during last week, highest level |
| | iii continuous or intermittent |
| | d aggravating or relieving factors |
| **5** | **Associated symptoms (eg nausea)** |
| **6** | **Effect of pain on activities and sleep** |
| **7** | **Treatment** |
| | a current and previous medications — dose, frequency of use, efficacy, side effects |
| | b other treatment eg transcutaneous electrical nerve stimulation |
| | c health professionals consulted |
| **8** | **Relevant medical history** |
| | a prior or coexisting pain conditions and treatment outcomes |
| | b prior or coexisting medical conditions |
| **9** | **Factors influencing the patient's symptomatic treatment** |
| | a belief concerning the causes of pain |
| | b knowledge, expectations and preferences for pain management |
| | c expectations of outcome of pain treatment |
| | d reduction in pain required for patient satisfaction or to resume 'reasonable activities' |
| | e typical coping response for stress or pain, including presence of anxiety or psychiatric disorders (eg depression or psychosis) |
| | f family expectations and beliefs about pain, stress and postoperative course |

## 2.2 Measurement

The definition of pain underlies the complexity of its measurement. Pain is an individual and subjective experience modulated by physiological, psychological and environmental factors such as previous events, culture, prognosis, coping strategies, fear and anxiety. Therefore, most measures of pain are based on self-report. These measures lead to sensitive and

consistent results if done properly (Moore et al, 2003). Self-report measures may be influenced by mood, sleep disturbance and medications (Scott & McDonald, 2008).

In some instances it may not be possible to obtain reliable self-reports of pain (eg patients with impaired consciousness or cognitive impairment, young children (see Section 10.3), elderly patients (see Section 11.2.3), or where there are failures of communication due to language difficulties, inability to understand the measures, unwillingness to cooperate or severe anxiety). In these circumstances other methods of pain assessment will be needed.

There are no objective measures of 'pain' but associated factors such as hyperalgesia (eg mechanical withdrawal threshold), the stress response (eg plasma cortisol concentrations), behavioural responses (eg facial expression), functional impairment (eg coughing, ambulation) or physiological responses (eg changes in heart rate) may provide additional information. Analgesic requirements (eg patient-controlled opioid doses delivered) are commonly used as *post hoc* measures of pain experienced (Moore et al, 2003).

Recording pain intensity as 'the fifth vital sign' aims to increase awareness and utilisation of pain assessment (JCAHO & NPC, 2001) and may lead to improved acute pain management (Gould et al, 1992 **Level III-3**). Regular and repeated measurements of pain should be made to assess ongoing adequacy of analgesic therapy. An appropriate frequency of reassessment will be determined by the duration and severity of the pain, patient needs and response, and the type of drug or intervention (Gordon et al, 2005). Such measurements should incorporate different components of pain. For example, in the postoperative patient this should include assessments of static (rest) and dynamic (on sitting, coughing or moving the affected part) pain. Whereas static measures may relate to the patient's ability to sleep, dynamic measures can provide a simple test for mechanical hyperalgesia and determine whether analgesia is adequate for recovery of function (Breivik et al, 2008).

Uncontrolled pain should always trigger a reassessment of the diagnosis and consideration of alternatives such as developing surgical or other complications, or the presence of neuropathic pain. Review by an acute pain service or other specialist group should be considered.

### 2.2.1 Unidimensional measures of pain

A number of scales are available that measure either pain intensity, or the degree of pain relief following an intervention. Pain *relief* scales, although less commonly used, have some advantage when comparing the response to different treatments, as all patients start with the same baseline relief score (zero), whereas they may have differing levels of baseline pain intensity (Moore et al, 2003; Breivik et al, 2008).

#### *Categorical scales*

Categorical scales use words to describe the magnitude of pain or the degree of pain relief (Moore et al, 2003). The verbal descriptor scale (VDS) is the most common example (eg using terms such as none, mild, moderate, severe and excruciating or agonising) typically using four or five graded descriptors.

These terms can then be converted to numeric scores (eg 0, 2, 5, 8, 10) for charting and easy comparison over time. There is a good correlation between descriptive verbal categories and visual analogue scales (Banos et al, 1989 **Level III-2**), but the VDS is a less sensitive measure of pain treatment outcome than the VAS (Jensen et al, 2002 **Level IV**). Pain *relief* may also be graded as none, mild, moderate or complete using a VDS.

Categorical scales have the advantage of being quick and simple and may be useful in the elderly or visually impaired patient and in some children. However, the limited number of

choices in categorical compared with numerical scales may make it more difficult to detect differences between treatments (Breivik et al, 2000 **Level II**). Other limitations include personal, cultural or linguistic differences in interpretation of the specific words chosen as descriptors both between patients and also between patients and their clinicians.

### *Numerical rating scales*

Numerical rating scales (NRS) have both written and verbal forms. Patients rate their pain intensity on the scale of 0 to 10 where 0 represents 'no pain' and 10 represents 'worst pain imaginable'. The Verbal NRS (VNRS) is typically administered using a phrase such as: 'On a scale of 0 to 10, with 0 being no pain at all and 10 being the worst pain you could imagine, where would you rate the pain you are experiencing right now?'. It is important that scales are consistent, and it is recommended that the 'no pain' point be represented as zero (0) rather than 1 (Scott & McDonald, 2008). Pain *relief* may be measured in the reverse direction with 0 representing 'no relief' to 10 representing 'complete relief'. A visual form of the 11-point NRS with tick marks on a line or boxes with numbers may also be used (Breivik et al, 2008). This is widely used, but some patients have difficulty representing their pain in numerical terms and are better suited to a categorical scale. A value of 4 or more is often used as a threshold to guide clinical intervention (Hartrick et al, 2003).

*Visual analogue scales* (VAS) consist of a 100 mm horizontal line with verbal anchors at both ends and no tick marks. The patient is asked to mark the line and the 'score' is the distance in millimetres from the left side of the scale to the mark. VAS are the most commonly used scales for rating pain intensity in research, with the words 'no pain' at the left end and 'worst pain imaginable' at the right. Pictorial versions also exist. VAS can also be used to measure other aspects of the pain experience (eg affective components, patient satisfaction, side effects).

Assessment of pain immediately after surgery can be more difficult and lead to greater interpatient variability in pain scores because of transient anaesthetic-related cognitive impairment and decreases in visual acuity. A 'pain meter' (PAULA) which used five coloured emoticon faces on the front of a ruler and corresponding VAS scores on the back, and allowed patients to move a slider to mark the pain they were experiencing, resulted in less variance than pain scores obtained from a standard VAS (Machata et al, 2009 **Level III-2**).

VAS ratings of greater than 70 mm are indicative of 'severe pain' (Aubrun et al, 2003 **Level IV**; Jensen et al, 2003 **Level IV**) and 0 to 5 mm 'no pain', 5 to 44 mm 'mild pain' and 45 to 74 'moderate pain' (Aubrun et al, 2003 **Level IV**). A reduction in pain intensity by 30% to 35% has been rated as clinically meaningful by patients with postoperative pain (Cepeda et al, 2003 **Level IV**; Jensen et al, 2003 **Level IV**), acute pain in the emergency department (Lee et al, 2003 **Level IV**), breakthrough cancer pain (Farrar et al, 2000 **Level IV**) and chronic pain (Farrar et al, 2001 **Level IV**).

These scales have the advantage of being simple and quick to use, allow for a wide choice of ratings and avoid imprecise descriptive terms (Scott & McDonald, 2008). However, the scales require more concentration and coordination, need physical devices, are unsuitable for children under 5 years and may also be unsuitable in up to 26% of adult patients (Cook et al, 1999).

The VAS has been shown to be a linear scale for patients with postoperative pain of mild–moderate intensity (Myles et al, 1999 **Level IV**) and severe pain (Myles & Urquhart, 2005 **Level IV**). Therefore, results are equally distributed across the scale, such that the difference in pain between each successive increment is equal.

*Verbal numerical rating scales* (VNRS) are often preferred because they are simpler to administer, give consistent results and correlate well with the VAS (Murphy et al, 1988 **Level IV**;

DeLoach et al, 1998 **Level IV**; Breivik et al, 2000 **Level IV**). Recall of pain intensity using the VNRS over the previous 24 hours was a reasonable indicator of average pain experienced by the patient during that time (Jensen et al, 2008 **Level III-2**).

Patients asked to rate their pain using a VNRS prior to and after morphine administration were also asked to rate their pain relief on a 5-point standard Likert scale as 0 = no pain relief, 1 = a little pain relief, 2 = moderate pain relief, 3 = a lot of pain relief and 4 = complete pain relief. The VNRS reductions associated with these pain relief ratings were 9.0, 7.5, 3.9, 2.1 and –0.1 respectively (Bernstein et al, 2006 **Level III-2**).

### 2.2.2 Functional impact of acute pain

Analgesia should be titrated to achieve both decreased pain intensity and the ability to undertake appropriate functional activity (Breivik et al, 2008). This will enable analgesia to optimise recovery. Most tools for measuring the functional impact of pain are based on chronic pain assessment, and therefore are not routinely applicable to the acute pain environment.

Measurement of pain intensity scores on movement or with coughing is a useful guide, however this reflects the subjective pain experience and not the capacity to undertake the specific activity. The Functional Activity Scale score (FAS score) is a simple three-level ranked categorical score designed to be applied at the point of care (Scott & McDonald, 2008). Its fundamental purpose is to assess whether the patient can undertake appropriate activity at their current level of pain control and to act as a trigger for intervention should this not be the case. The patient is asked to perform the activity, or is taken through the activity in the case of structured physiotherapy (joint mobilisation) or nurse-assisted care (eg ambulation, turned in bed). The ability to complete the activity is then assessed using the FAS as:

| | |
|---|---|
| A — no limitation | the patient is able to undertake the activity without limitation due to pain (pain intensity score is typically 0 to 3); |
| B — mild limitation | the patient is able to undertake the activity but experiences moderate to severe pain (pain intensity score is typically 4 to 10); and |
| C — significant limitation | the patient is unable to complete the activity due to pain, or pain treatment-related side effects, independent of pain intensity scores. |

This score is then used to track effectiveness of analgesia on function and trigger interventions if required. Disadvantages of the FAS score are that it has not been independently validated and clinical staff need to be educated in its application.

### 2.2.3 Multidimensional measures of pain

Rather than assessing only pain intensity, multidimensional tools provide further information about the characteristics of the pain and its impact on the individual. Examples include the Brief Pain Inventory, which assesses pain intensity and associated disability (Daut et al, 1983) and the McGill Pain Questionnaire, which assesses the sensory, affective and evaluative dimensions of pain (Melzack, 1987).

Unidimensional tools such as the VAS are inadequate when it comes to quantifying neuropathic pain. Specific scales have been developed that identify (and/or quantify) descriptive factors specific for neuropathic pain (Bouhassira et al, 2004 **Level IV**; Cruccu et al, 2004 **Level IV**; Bouhassira et al, 2005 **Level IV**; Dworkin et al, 2007 **Level III-2**) and that may also include

sensory examination (Cruccu et al, 2004; Bouhassira et al, 2005) and allow evaluation of response to treatment (Bouhassira et al, 2004).

Global scales are designed to measure the effectiveness of overall treatment (see Section 2.3.1). They are more suited to outcome evaluation at the end of treatment than to modifying treatment in the acute stage (Moore et al, 2003). Questions such as 'How effective do you think the treatment was?' recognise that unimodal measures of pain intensity cannot adequately represent all aspects of pain perception.

Satisfaction is often used as a global indicator of outcome, however patients may report high levels of satisfaction even if they have moderate to severe acute pain (Svensson et al, 2001 **Level IV**). Satisfaction may also be influenced by preoperative expectations of pain, effectiveness of pain relief, the patient–provider relationship (eg communication by medical and nursing staff), interference with function due to pain and number of opioid-related side effects (Svensson et al, 2001 **Level IV**; Carlson et al, 2003 **Level IV**; Jensen et al, 2004 **Level IV**). Although complete absence of pain is not required for patients to report high levels of satisfaction, moderate pain (VAS greater than 50, scale 0 to 100) has been associated with dissatisfaction (Jensen et al, 2005 **Level III-2**).



### 2.2.4 Patients with special needs

Validated tools are available for measuring pain in neonates, infants and children, but must be both age and developmentally appropriate (see Section 10.3). These include behavioural assessments, pictorial scales (eg faces) and response to treatment. Adult patients who have difficulty communicating their pain (eg patients with cognitive impairment or who are critically unwell in the emergency department or intensive care) require special attention as do patients whose language or cultural background differs significantly from that of their health care team (see Sections 9.8, 9.9, 11.2.3, 11.3 and 11.4). Communication aids and behavioural scales such as the modified Faces, Legs, Activity, Cry and Consolability (FLACC) scale (Erdek & Pronovost, 2004) can be particularly useful in these situations (see Section 11.2.3).

**Key messages**

1. Regular assessment of pain leads to improved acute pain management (**U**) (**Level III-3**).
2. There is good correlation between the visual analogue and numerical rating scales (**U**) (**Level III-2**).

The following tick boxes ☑ represent conclusions based on clinical experience and expert opinion.

☑ Self-reporting of pain should be used whenever appropriate as pain is by definition a subjective experience (**U**).

☑ The pain measurement tool chosen should be appropriate to the individual patient; developmental, cognitive, emotional, language and cultural factors should be considered (**U**).

☑ Scoring should incorporate different components of pain including the functional capacity of the patient. In the postoperative patient this should include static (rest) and dynamic (eg pain on sitting, coughing) pain (**U**).

☑ Uncontrolled or unexpected pain requires a reassessment of the diagnosis and consideration of alternative causes for the pain (eg new surgical/ medical diagnosis, neuropathic pain) (**U**).

## 2.3 Outcome measures in acute pain management

What follows is a brief guide to some of the outcome measures used particularly in the acute pain literature. A comprehensive review is beyond the scope of this document and more detail may be found elsewhere (Breivik et al, 2008).

### 2.3.1 Outcome measures

*Pain*

The aim of many clinical trials is to determine whether a drug or intervention provides adequate pain relief for the majority of participants or is equivalent or non-inferior to an existing accepted treatment. This can be achieved by repeated single measures at fixed time points, which may encompass only a proportion of the total illness. When comparison is made with a placebo, a statistically significant result can be achieved with a relatively small number of patients (eg n=40) (Collins et al, 2001). The primary outcome is chosen by the researcher and may not be of direct importance to the individual patient, particularly if it relates to only a proportion of the total time he/she was in pain. It is also important to consider that statistically significant differences in pain scores may not reflect clinically significant differences, although these are harder to define (see above).

Data derived from categorical and visual analogue scales of pain intensity or relief produce a range of summary outcomes that can be used to assess (Moore et al, 2003):

- the degree of analgesic effect:
  - difference between the baseline and postintervention score of pain intensity or pain relief (Summed pain intensity difference [SPID]);
  - the area under the time-analgesic effect curve for a given time (total pain relief [TOTPAR]);
  - dose of rescue analgesic consumption required in a given time period (eg PCA use);
- the time to analgesic effect:
  - the time to onset of analgesic effect;
  - mean time to maximum reduction in pain intensity or to peak relief;
- the duration of effect:
  - time for pain to return to at least 50% of baseline;
  - time for pain intensity to return to baseline or for pain relief to fall to zero;
  - time to remedication/rescue analgesia.

A widely used method of describing the effectiveness of an analgesic intervention is the number-needed-to-treat (NNT). In this setting it is commonly defined as the number of patients that need to be treated to achieve at least 50% pain relief (eg at least 50% maximum TOTPAR) in one patient compared with a placebo over a 4 to 6 hour treatment period (Moore et al, 2003). Analysis at other cut-off points (30% to 70% max TOTPAR) has shown the same relative efficacy of different treatments (McQuay et al, 2003).

The validity of this approach as a true method of comparison may be questioned as there is no standardisation of the acute pain model or patient and only single doses of the analgesic agents are used. However, it may sometimes be reasonable to extrapolate estimates of analgesic efficacy from one pain model to another (Barden et al, 2004 **Level I**).

The use of supplemental analgesic consumption as an outcome measure has been questioned in situations where pain scores are not similar (McQuay et al, 2008).

### *Physical functioning*

Measures of physical functioning quantify many aspects of a patient's life including their ability to sleep, eat, think, deep breathe, cough, mobilise, perform activities of self-care and daily living, undertake their usual vocation, and to enjoy leisure activities and sport (Williams, 1999). In acute pain this may be measured by pain intensity scores with movement or other functional activity scores (see above).

Global or multidimensional measures of function attempt to combine various abilities or disabilities to derive a summary measure. Scales that employ a large number of items might be comprehensive but risk patient exhaustion or error, while scales with fewer items might be patient-friendly but risk becoming insensitive to state or change (Williams, 1999). These scales have been used in some studies of acute spinal pain and cancer-related pain:

- *disability scales* — generic scales include the Short Form 36 of Medical Outcomes Study (SF-36), the Sickness Impact Profile (SIP), and Roland & Morris Short SIP (Williams, 1999); and
- *Quality of life (QOL) measures* — these measures are not widely used in pain studies other than for cancer-related pain (Higginson, 1997).

Disease-specific measures quantify the impact of a specific pain problem on function and can be used to track changes after an intervention (eg ability to cough after thoracotomy, ability to lift a baby after Caesarean section) (Garratt et al, 2001). Generic measures facilitate comparisons among the functional limitations of different conditions and treatments, and may have advantages for audit of an acute pain service that includes patients with a range of conditions (Patrick & Deyo, 1989).

### *Emotional functioning*

Acute pain is an unpleasant sensory and emotional experience. The unpleasantness of the experience and its meaning for the individual may have short-term (anxiety, depression, irritability) and long-term consequences (lost confidence or self-efficacy or post-traumatic stress disorder) for the individual's emotional functioning.

### *Adverse symptoms and events*

In trials of efficacy, adverse events are usually considered to be of secondary importance and inadequate reporting has been found in as many as half of randomised trials reviewed (Edwards et al, 1999; Ioannidis & Lau, 2001). If adverse events are sufficiently common (eg nausea with opioids) they may be quantifiable in trials of efficacy and specifically measured using dichotomous (present or absent), categorical (none, mild, moderate, severe) or interval (analogue or Likert) scales. Analogous to NNTs, the number-needed-to-harm (NNH) may be used to describe the incidence of adverse effects.

Most efficacy trials will have inadequate power to detect rare adverse events and therefore they are also absent from systematic reviews. Large clinical trials specifically designed to detect adverse events are required (eg the VIGOR study investigated GI toxicity and NSAIDs) (Bombardier et al, 2000). Case reports and postmarketing epidemiological research and surveillance (eg the Australian Adverse Drug Reactions Advisory Committee) remain important for detection of delayed events occurring after the initial trial period. More recently, results from comprehensive large prospective audits and database reviews have provided a sufficiently reliable denominator for incidence and risk factor evaluation in rare but serious adverse outcomes in acute pain management (Cameron et al, 2007 **Level IV**; Wijeysundera et al, 2008 **Level IV**; Wijeysundera & Feldman, 2008).

Besides the adverse outcomes attributed to acute pain management interventions, another area of interest is whether the adverse outcomes of trauma and surgery might be prevented by effective acute pain management. Outcomes such as mortality, morbidity due to derangements of the cardiovascular, respiratory, GI and coagulation systems and progression to chronic pain have also been reported (see Section 1.3).

**Key message**

The following tick box ☑ represents conclusions based on clinical experience and expert opinion.

☑ Multiple outcome measures are required to adequately capture the complexity of the pain experience and how it may be modified by pain management interventions (**U**).



## References


Aubrun F, Langeron O, Quesnel C et al (2003) Relationships between measurement of pain using visual analog score and morphine requirements during postoperative intravenous morphine titration. *Anesthesiology* **98**(6): 1415–21.

Backonja MM & Krause SJ (2003) Neuropathic pain questionnaire–short form. *Clin J Pain* **19**(5): 315–6.

Banos JE, Bosch F, Canellas M et al (1989) Acceptability of visual analogue scales in the clinical setting: a comparison with verbal rating scales in postoperative pain. *Methods Find Exp Clin Pharmacol* **11**(2): 123–7.

Barden J, Edwards JE, McQuay HJ et al (2004) Pain and analgesic response after third molar extraction and other postsurgical pain. *Pain* **107**(1-2): 86–90.

Bernstein SL, Bijur PE & Gallagher EJ (2006) Relationship between intensity and relief in patients with acute severe pain. *Am J Emerg Med* **24**(2): 162–6.

Bombardier C, Laine L, Reicin A et al (2000) Comparison of upper gastrointestinal toxicity of rofecoxib and naproxen in patients with rheumatoid arthritis. VIGOR Study Group. *N Engl J Med* **343**(21): 1520–8.

Bouhassira D, Attal N, Fermanian J et al (2004) Development and validation of the Neuropathic Pain Symptom Inventory. *Pain* **108**(3): 248–57.

Bouhassira D, Attal N, Alchaar H et al (2005) Comparison of pain syndromes associated with nervous or somatic lesions and development of a new neuropathic pain diagnostic questionnaire (DN4). *Pain* **114**(1-2): 29–36.

Breivik EK, Bjornsson GA & Skovlund E (2000) A comparison of pain rating scales by sampling from clinical trial data. *Clin J Pain* **16**(1): 22–8.

Breivik H, Borchgrevink PC, Allen SM et al (2008) Assessment of pain. *Br J Anaesth* **101**(1): 17–24.

Cameron CM, Scott DA, McDonald WM et al (2007) A review of neuraxial epidural morbidity: experience of more than 8,000 cases at a single teaching hospital. *Anesthesiology* **106**(5): 997–1002.

Carlson J, Youngblood R, Dalton JA et al (2003) Is patient satisfaction a legitimate outcome of pain management? *J Pain Symptom Manage* **25**(3): 264–75.

Cepeda MS, Africano JM, Polo R et al (2003) What decline in pain intensity is meaningful to patients with acute pain? *Pain* **105**(1-2): 151–7.

Collins SL, Edwards J, Moore RA et al (2001) Seeking a simple measure of analgesia for mega-trials: is a single global assessment good enough? *Pain* **91**(1-2): 189–94.

Cook AK, Niven CA & Downs MG (1999) Assessing the pain of people with cognitive impairment. *Int J Geriatr Psychiatry* **14**(6): 421–5.

Cruccu G, Anand P, Attal N et al (2004) EFNS guidelines on neuropathic pain assessment. *Eur J Neurol* **11**(3): 153–62.

Daut RL, Cleeland CS & Flanery RC (1983) Development of the Wisconsin Brief Pain Questionnaire to assess pain in cancer and other diseases. *Pain* **17**(2): 197–210.

DeLoach LJ, Higgins MS, Caplan AB et al (1998) The visual analog scale in the immediate postoperative period: intrasubject variability and correlation with a numeric scale. *Anesth Analg* **86**(1): 102–6.

Dworkin RH, Jensen MP, Gammaitoni AR et al (2007) Symptom profiles differ in patients with neuropathic versus non-neuropathic pain. *J Pain* **8**(2): 118–26.

Edwards JE, McQuay HJ, Moore RA et al (1999) Reporting of adverse effects in clinical trials should be improved: lessons from acute postoperative pain. *J Pain Symptom Manage* **18**(6): 427–37.

Erdek MA & Pronovost PJ (2004) Improving assessment and treatment of pain in the critically ill. *Int J Qual Health Care* **16**(1): 59–64.

Farrar JT, Portenoy RK, Berlin JA et al (2000) Defining the clinically important difference in pain outcome measures. *Pain* **88**(3): 287–94.

Farrar JT, Young JP, Jr., LaMoreaux L et al (2001) Clinical importance of changes in chronic pain intensity measured on an 11-point numerical pain rating scale. *Pain* **94**(2): 149–58.

Garratt AM, Klaber Moffett J & Farrin AJ (2001) Responsiveness of generic and specific measures of health outcome in low back pain. *Spine* **26**(1): 71–7.

Gordon DB, Dahl JL, Miaskowski C et al (2005) American pain society recommendations for improving the quality of acute and cancer pain management: American Pain Society Quality of Care Task Force. *Arch Intern Med* **165**(14): 1574–80.

Gould TH, Crosby DL, Harmer M et al (1992) Policy for controlling pain after surgery: effect of sequential changes in management. *BMJ* **305**(6863): 1187–93.

Gray P (2008) Acute neuropathic pain: diagnosis and treatment. *Curr Opin Anaesthesiol* **21**(5): 590–5.

Hartrick CT, Kovan JP & Shapiro S (2003) The Numeric Rating Scale for Clinical Pain Measurement: A Ratio Measure? *Pain Practice* **3**(4): 310–16.

Higginson IJ (1997) Innovations in assessment: epidemiology and assessment of pain in advanced cancer. In: *Proceedings of the 8th World Congress on Pain, Progress in Pain Research and Management* edn. Jensen TS, Turner JA and Weisenfeld-Hallin Z (eds). Seattle, IASP Press. 8: 707–16.

Ioannidis JP & Lau J (2001) Completeness of safety reporting in randomized trials: an evaluation of 7 medical areas. *JAMA* **285**(4): 437–43.

JCAHO & NPC (2001) *Pain: Current Understanding of Assessment, Management and Treatments*. www.jcaho.org/news+room/health+care+issues/pm+monographs.htm Joint Commission on Accreditation of Healthcare Organisations and the National Pharmaceutical Council, Inc.

Jensen MP, Chen C & Brugger AM (2002) Postsurgical pain outcome assessment. *Pain* **99**(1-2): 101–9.

Jensen MP, Chen C & Brugger AM (2003) Interpretation of visual analog scale ratings and change scores: a reanalysis of two clinical trials of postoperative pain. *J Pain* **4**(7): 407–14.

Jensen MP, Mendoza T, Hanna DB et al (2004) The analgesic effects that underlie patient satisfaction with treatment. *Pain* **110**(1-2): 480–7.

Jensen MP, Martin SA & Cheung R (2005) The meaning of pain relief in a clinical trial. *J Pain* **6**(6): 400–6.

Jensen MP, Mardekian J, Lakshminarayanan M et al (2008) Validity of 24-h recall ratings of pain severity: biasing effects of "Peak" and "End" pain. *Pain* **137**(2): 422–7.

Lee JS, Hobden E, Stiell IG et al (2003) Clinically important change in the visual analog scale after adequate pain control. *Acad Emerg Med* **10**(10): 1128–30.

Machata AM, Kabon B, Willschke H et al (2009) A new instrument for pain assessment in the immediate postoperative period. *Anaesthesia* **64**(4): 392–8.

McQuay HJ, Barden J & Moore RA (2003) Clinically important changes-what's important and whose change is it anyway? *J Pain Symptom Manage* **25**(5): 395–6.

McQuay HJ, Poon KH, Derry S et al (2008) Acute pain: combination treatments and how we measure their efficacy. *Br J Anaesth* **101**(1): 69–76.

Melzack R (1987) The short-form McGill Pain Questionnaire. *Pain* **30**(2): 191–7.

Moore A, Edwards J, Barden J et al (2003) Bandolier's Little Book of Pain. Oxford, Oxford University Press.

Murphy DF, McDonald A, Power C et al (1988) Measurement of pain: A comparison of the visual analogue with a nonvisual analogue scale. *Clin J Pain* **3**(4): 191–97.

Myles PS, Troedel S, Boquest M et al (1999) The pain visual analog scale: is it linear or nonlinear? *Anesth Analg* **89**(6): 1517–20.

Myles PS & Urquhart N (2005) The Linearity of the Visual Analogue Scale in Patients with Severe Acute Pain. *Anaesth Intensive Care* **33**(1): 54–58.

Patrick DL & Deyo RA (1989) Generic and disease-specific measures in assessing health status and quality of life. *Med Care* **27**(3 Suppl): S217–32.

Scott DA & McDonald WM (2008) Assessment, Measurement and History. In: *Textbook of Clinical Pain Management* 2E edn. Macintyre PE, Rowbotham D and Walker S (eds). Acute Pain.

Svensson I, Sjostrom B & Haljamae H (2001) Influence of expectations and actual pain experiences on satisfaction with postoperative pain management. *Eur J Pain* **5**(2): 125–33.

Victor TW, Jensen MP, Gammaitoni AR et al (2008) The dimensions of pain quality: factor analysis of the Pain Quality Assessment Scale. *Clin J Pain* **24**(6): 550–5.

Wijeysundera DN, Beattie WS, Austin PC et al (2008) Epidural anaesthesia and survival after intermediate-to-high risk non-cardiac surgery: a population-based cohort study. *Lancet* **372**(9638): 562–9.

Wijeysundera DN & Feldman BM (2008) Quality, not just quantity: the role of qualitative methods in anesthesia research. *Can J Anaesth* **55**(10): 670–3.

Williams AdC (1999) Measures of function and psychology. In: *Textbook of Pain* 4th edn. Wall P and Melzack R (eds). Edinburgh, Churchill Livingstone. 427–44.

Woolf CJ & Max MB (2001) Mechanism-based pain diagnosis: issues for analgesic drug development. *Anesthesiology* **95**(1): 241–9.