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Organization and role of acute pain services

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KEY LEARNING POINTS

- Postoperative and other acute pain continue to be poorly managed, causing unnecessary suffering and increasing risk of complications after surgery and injury.
- The institution of acute pain services (APS) leads to improved pain relief and reduces treatment-related side effects.
- There are many models of APS; the superiority of one over another has not been shown and local circumstances may determine which will function best.
- Staff education, a key role of an APS, is a prerequisite for better pain assessment, improved prescribing practices, and better acute pain relief.
- Improved acute pain management results more from the APS educational activities and appropriate organizational delivery of pain relief than from the techniques themselves.
- When attention is given to education, patient assessment, documentation, and provision of appropriate guidelines and policies, even basic "low-tech" techniques of pain relief are more effective.
- Close liaison with all personnel involved in the care of the patient is required for successful management of acute pain. This goal is reached by an ongoing educational program delivered by a well-staffed and well-trained APS.

INTRODUCTION

Objectives in acute pain management can be summarized in four broad categories. These may help to determine the requirements for analgesic management in terms of the technique and service structure required for delivery of effective acute pain relief.

Humanitarian

The need to prevent or reduce unnecessary pain and suffering is clearly important.[1, 2, 3] It would seem an obvious intention, but the evidence from *Pain after surgery*[4] suggests that before this report the prevailing attitude was that pain, often severe pain, was to be expected after surgery and that medical and nursing staff were ill-equipped to deal with it.

Avoidance of the pathophysiological consequences of untreated severe pain

It is now realized that pain may have significant adverse physiological and psychological effects and that many of the well-recognized complications of surgery are precipitated or aggravated by poorly treated acute pain.[5]

In high risk patients, i.e. those having major thoracic or abdominal surgery or with significant medical

comorbidities, the need for effective analgesia becomes paramount in attempts to reduce perioperative morbidity. Especially important is the ability to achieve "dynamic analgesia," i.e. to reduce pain provoked by movement, e.g. with coughing and deep breathing early in the postoperative period.

Reducing the risk of chronic pain

Some common operations may lead to chronic pain syndromes.[6, 7, 8] Increased understanding of nociception and pain impulse processing in the central nervous system has raised hopes that better acute pain management may lead to a reduction in the incidence of severe chronic postoperative pain.[9, 10] For more information on the prevalence of chronic pain after surgery and evidence for its prevention see Chapter 31, Preventing chronic pain after surgery, in the *Acute Pain* volume of this series, and Chapter 30, Chronic pain after surgery, in the *Chronic Pain* volume of this series.

Preservation of vital organ functions and fast-track recovery

This is of particular importance in accelerated recovery (fast-track surgery) programs where early mobilization and nutrition are primary objectives that cannot be achieved unless acute pain is well managed.[11, 12, 13, 14, 15]

It could be argued that all these objectives are universal in pain management and indeed that is so. What perhaps distinguishes acute pain management from chronic pain management is the urgency with which effective analgesia is required, particularly if patients are at risk of pain-related adverse events.

The World Health Organization (WHO) analgesic ladder is a well-known tool for managing pain relief that is often applied inappropriately in the acute pain setting with simple analgesics being prescribed as first line resulting in undertreatment of pain. That said, the ladder is useful in the treatment of acute pain, providing one realizes the need to descend rather than ascend the ladder beginning with strong opioids or invasive analgesic techniques and reducing to simple analgesics as the acute response to injury subsides.

Increasing recognition of inadequate acute pain management

Despite these objectives, studies over the last few decades have consistently shown that acute pain management is often still suboptimal, with up to two-thirds of surgical and medical patients experiencing moderate to severe pain during their hospital stay.[16, 17, 18, 19, 20, 21, 22]

The consequences have been increasing use of more sophisticated methods of pain relief in general hospital wards and in ambulatory settings, the development of acute pain services (APS), and guidelines and reports relevant to acute pain management. Some of these guidelines and reports are listed below.

- The Royal College of Surgeons and College of Anaesthetists: *Working party report on pain after surgery*, 1990.[4]
- Faculty of Anaesthetists and Royal Australasian College of Surgeons: *Statement on acute pain management*, 1991.[23]
- International Association for the Study of Pain (IASP) *Task Force on Acute Pain: Management of acute pain: a practical guide*, 1992.[24]
- US Department of Health and Human Services, Agency for Health Care Policy and Research (AHCPR), Clinical Practice Guideline. *Acute pain management: operative or medical procedures and trauma*, 1992.[25]
- American Society of Anesthesiologists (ASA): *Practice guidelines for acute pain management in the perioperative setting*, 1995.[26]
- College of Paediatrics and Child Health Working Party Report: *Prevention and control of pain in children*, 1997.[27]
- Association of Anaesthetists of Great Britain and Ireland: *The anaesthesia team*, 1998.[28]
- UK Audit Commission Report: *Anaesthesia under examination*, 1998.[29]
- Europain: *Minimum standards for the management of postoperative pain*, 1998.[30]
- National Health and Medical Research Council (Australia) Working Party Report: *Acute pain management: scientific evidence*, 1999.[31]
- Veterans Health Administration and Department of Defense in the USA: *Clinical practice guidelines for the management of postoperative pain*.[32] An updated copy of these guidelines can be found at www.oqp.med.va.gov/cpg/PAIN/PAIN_GOL.htm
- Joint publication by several UK professional bodies: *Good practice in the management of continuous epidural analgesia in the hospital setting*, 2004.[33]
- American Society of Anesthesiologists (ASA): *Practice guidelines for acute pain management in the perioperative setting: an updated report by the American Society of Anesthesiologists Task Force on Acute Pain Management*.[34]
- Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine: *Acute pain management: scientific evidence*, 2nd edn, 2005.[35]
- Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine: *Guidelines on acute pain management*, 2007.[36]
- British Pain Society publication: *Pain and substance misuse: improving the patient experience*, 2007.[37]
- PROSPECT: *Procedure-specific postoperative pain management*.[38]

The report of the Royal College of Surgeons and College of Anaesthetists[4] stated that an APS "should be introduced in all major hospitals performing surgery in the UK" and later recommendations from the Faculty of Anaesthetists,[23] AHCPR,[25] and American Society of Anesthesiologists[26] agreed that all major acute care centers should have an APS.

In part as a result of the earlier reports and guidelines, as well as increasing awareness of the need to treat acute pain and the potential benefits of providing good-quality analgesia, the proportion of hospitals with APS has risen, as has recognition of the need for an APS. Although the model of APS may vary (see below under Organization of acute pain services), in the UK[39] and Canada[40] around 90 percent of hospitals now have an APS. However, the definition of what constitutes an APS can vary from institution to institution. In a postal survey of APS in hospitals in the UK (81 percent response rate), 86 percent provided a weekday service with a reduced service at other times; only 5 percent provided 24-hour service, seven days a week.[41]

THE DEVELOPMENT AND GROWTH OF ACUTE PAIN SERVICES

Advanced pain relief techniques, such as patient-controlled analgesia (PCA) and epidural analgesia, had been used for the management of acute pain for some years before the advent of APS. However, their use in a general ward setting did not become widespread until after APS had been established.

While the idea for an anesthesiologist-led analgesia team to supervise acute pain relief and take responsibility for education, was mooted as early as 1976,[42] the development of these teams did not start until a decade later. The landmark publication by Ready *et al*. in 1988,[43] which described the beginning of their APS in the USA and the first 18 months' experience, heralded the start of the rapid development and growth of organized APS. Starting within a short time after this and then increasing rapidly over the next 20 years, other countries including Australia,[44, 45] the UK,[46, 47, 48] New Zealand,[49] Germany,[50, 51] Canada,[52] Ireland,[53] Spain,[54] Israel,[55, 56] Belgium,[57, 58] Italy,[59] Norway and Switzerland,[60] Sweden,[61] Denmark,[62] Poland,[63] Saudi Arabia,[64] Hong Kong,[65, 66] Malaysia,[67, 68] Singapore,[69, 70] and Thailand[71] followed suit.

The changing role of the acute pain service

The APS started by Ready *et al*.[43] over 20 years ago aimed primarily to manage acute postoperative pain using one of the more "high-tech" methods of pain relief, such as PCA and epidural analgesia. Changes over time have seen APS play a major role in also improving the effectiveness of more conventional "low-tech" methods of pain relief, so that more patients in a hospital will benefit.[72, 73]

The concept of the APS, as a postoperative pain management service, has also changed over that period, both in the way that these services are run and in the range of services they provide.

In the early days, the focus followed the excellent recommendations in *Pain after surgery*[4] summarized below:

- responsibility for the day-to-day management of acute pain after surgery;
- organization of services so that the level of care and monitoring is appropriate for both the clinical condition of the patient and the technique involved;
- provision of in-service training for medical and nursing staff involved in the management of postoperative pain;
- establishment of programs for the diagnosis and management of the complications and hazards of particular forms of treatment;
- audit of the beneficial and detrimental outcomes of existing methods of treatment and evaluation of new techniques;
- clinical research into the relief of acute pain.

In recent years, APS have found themselves being called upon to provide assistance in other areas of the hospital where pain management is problematic, away from the primary remit of managing postoperative pain. In many hospitals, input from APS has facilitated improvements in pain management for daycase surgery,[74, 75] in emergency medicine departments,[76, 77, 78] and pediatric wards,[79, 80, 81] and also pioneered techniques to manage procedural pain in many situations.[82, 83, 84, 85, 86, 87] In addition to these roles, APS have come under increasing pressure to assume a role in improving pain management on medical wards, where poor pain relief remains a major concern.[17, 88]

Other developments in the understanding of pain have demonstrated that acute pain and chronic pain are not separate entities, but part of a pain continuum, and that neuropathic pain is often a factor in the acute pain setting. This requires APS teams to recognize and implement early treatment using drugs and techniques more traditionally associated with chronic pain therapies.[7, 89]

Acute pain services are also called upon to deal with increasingly more complex pain management issues, such as acute on chronic pain, acute pain after spinal cord injury, and other major trauma, and acute medical pain (e.g. acute herpes zoster, sickle cell crisis, pain associated with HIV/AIDS, cardiac pain) and increasingly more complex patient groups (e.g. opioid-tolerant patients, patients with a substance abuse disorder, the elderly, and patients with obstructive sleep apnea).[35, 72] In view of the wider demands on modern APS, and the increased

knowledge required by individuals previously seen as acute pain practitioners, it might be that the term "in-patient pain service" is now a more appropriate title than acute pain service.

Finally, members of some APS teams are becoming more involved in perioperative medicine[15] and outreach critical care services,[90, 91] as well as accelerated post-operative recovery programs following major surgery. These fast-track programs rely heavily upon the provision of effective analgesia and present new challenges in providing pain relief that facilitates early mobilization and early oral intake.[11, 15, 92]

Models of APS organization

There has been some debate as to the best form of APS and there is, as yet, no consensus about the best model or even agreed definitions of what might constitute an APS. Therefore, the structure of APS varies widely, depending on local patients' profiles, local traditions, and responsibilities for care of surgical and medical patients. For the purposes of training in multidisciplinary pain medicine, the Faculty of Pain Medicine in Australia states that an APS must have at least one specialist anesthesiologist session (a session is a half day) and one nursing session allocated each weekday, as well as 24-hour availability of a specialist anesthesiologist for consultation.[93] For training in anesthesia, both the Royal College of Anaesthetists in the UK and the Australian and New Zealand College of Anaesthetists require all institutions with anesthesia trainees to have an APS. Similar requirements exist in Norway and the other Nordic countries. In Australia, 91 percent of training hospitals have an APS run by the Department of Anaesthesia, with daily input from medical staff (Australian and New Zealand College of Anaesthetists, personal communication). A recent survey of training hospitals in the in the UK showed that while 90 percent of hospitals reported having an APS, dedicated medical staff sessions did not exist in 37 percent, were limited to one to two sessions per week in 49 percent, and in only 4 percent were there five or more sessions.[39]

Currently, APS structures vary from nurse-based/anesthesiologist-led, without daily participation by an anesthesiologist[55, 73] to anesthesiologist-based/nurse-supported – anesthesiology leadership being common because the knowledge required and techniques used are similar to those used in anesthesia.[43, 44, 49] All rely on APS nurses and, regardless of the model chosen, an organized team approach is essential.

The nurse-based, anesthesiologist-supervised model described by Rawal[73] seeks to involve all nurses in the provision of better analgesia, regardless of technique used. It proposes that improved education and regular monitoring of pain and pain relief ("making pain visible") will lead to better analgesia for all patients. The anesthesiologist-led model of Ready *et al.*[43] has been criticized as being costly because only a small proportion of patients receive its benefits.[94] That is, it forgets the many patients whose pain will be treated using one of the more conventional analgesic regimens (e.g. intermittent intramuscular or oral opioids), prescribed by junior medical staff. However, this need not and should not be the case (see below under Selection of analgesic regimens).

Werner *et al.*[95] performed a systematic review of articles relating to APS. Of the 73 articles they reviewed which discussed organizational aspects, the APS was physician-based (usually anesthesiologist) in 56 (77 percent) and 17 (23 percent) were nurse-based. There was no evidence to suggest that either model is superior.

Unfortunately, some anesthesiologist-based APS have tended to concentrate on the high-tech approaches to pain relief, placing less emphasis on improving simple methods of pain relief throughout their hospital. This approach benefits only a small proportion of patients. This need not be the case, if, as with the nurse-based service, the anesthesiologist-based APS assists in the development of better protocols for all analgesic regimens used throughout the hospital.[72, 96]

Story *et al.*[90] reported on the results of a combined physician-based critical care outreach and APS team comprising both anesthesiologists and nursing staff. They conducted a prospective, before-and-after trial of standard acute pain management followed by a period when high-risk postoperative patients were reviewed for the first three days after their return to a general ward by a combined APS and medical emergency team they called IMPACT (Inpatient Management of acute Pain and Advice on Clinical Treatment). They showed that an APS providing critical care outreach may improve post-operative outcome: the incidence of serious adverse events decreased from 23 events per 100 patients to 16 events per 100 patients and the 30-day mortality decreased from 9 to 3 percent ($p = 0.004$).[90]

In the UK and Nordic countries, APS appear to have developed following two basic models often determined by the priorities of the physician originally directing the service. Setting up an APS was undertaken in many hospitals by clinicians already involved in chronic pain work. Under these circumstances, provision of acute pain management is under the umbrella of a comprehensive pain service with the same nurses and doctors providing input into both acute and chronic pain management.

In contrast, other services were initiated by clinicians with an interest in improving perioperative care, seeing pain as a crucial element in patient management during this critical period. Such services have frequently developed as distinct APS separate from the chronic pain service (CPS) resources and personnel and often with links into perioperative care initiatives, such as outreach critical care services,[97] which in the UK have developed using a nurse practitioner model similar to that of many UK APS.[91] Advocates of this latter model suggest that acute and chronic pain management services do not sit comfortably

together arguing that acute pain work is largely inpatient-based, while chronic pain work is largely in outpatients and that the urgency required in acute pain work is at odds with the long review times for most chronic pain therapies.

However the APS is organized, cooperation between acute and chronic sectors is crucial if appropriate management of complex patients is to be facilitated, as these patients frequently require input from practitioners with chronic pain knowledge during the inpatient phase of their treatment and subsequent follow up as an outpatient. It is also important to keep clear business objectives for both arms of the service as the requirements of each are often very different, and to ensure that staff appointed to APS duties are not assimilated into running CPS to the detriment of the APS (and vice versa). Clear thinking, even to the point of submitting separate business plans, helps to clarify the requirements of both services and presents an opportunity to clarify the resource requirements and objectives of the two services.

Regardless of the model chosen, the philosophy with which to approach acute pain work is that of "working to put the acute pain team out of business" by striving, through education and training, to disseminate the work of the team down to ward level. To some degree, this philosophy has been successful with concepts such as multimodal analgesia now being widely understood and with PCA and epidural analgesia being largely managed at ward level by ward staff. That said, it is unlikely that APS will ever be unemployed due to the ever-increasing demands brought on by the increasing number of complex challenges (see above under The changing role of the acute pain service).

Initiating an acute pain service

Initiating and developing an APS is a major undertaking which requires the support of medical and nursing staff and hospital managers. Also needed are all of the factors covered below under Resources required which looks at organization of an APS – education, appropriate selection of analgesic regimens, provision of standardized protocols and guidelines, and audit and quality improvement programs.

The management of this change can be difficult. For further information on change management using the establishment of APS as an example, see Chapter 48, Acute pain services and organizational change.

RESOURCES REQUIRED

At an institutional level, a key factor limiting the effectiveness of acute pain management is a lack of resources. Such resources include adequate staffing (medical and nursing) both within- and after-hours, the time and personnel required for education of staff and patients, the time and personnel required for assessment and appropriate monitoring of patients, and the provision of appropriate drugs and equipment.

It is also recognized that once established, an APS may rapidly have requests to expand the service, for example into daycase surgery,[74, 75] emergency medicine departments,[76, 77, 78] pediatric wards,[79, 80, 81] procedural settings,[82, 83, 84, 85, 86, 87] and medical wards.[17, 88]

The director of the APS has to ensure that the work being undertaken by the service does not exceed available resources. It is, of course, desirable to run an APS that is inclusive and able to deal with all aspects of pain management in the inpatient population, but this must be tempered with common sense regarding priorities when resources are limited – as they inevitably are. Patients in severe acute pain in the early postoperative period must continue to take precedence as this situation may lead on to increased postoperative morbidity and possibly even mortality. These patients may require urgent intervention 24 hours, seven days per week.

As the service expands its role, it is essential to identify and highlight the increased resource requirements of these developments well in advance so as not to undermine existing service provision. Service expansion is inevitable and indeed desirable, facilitating improvements in pain management in many sectors of the hospital, but resources must be forthcoming. In order to ensure success in developing resources, it is vital that the surgical and medical staff, as well as the hospital administration, understand and support the APS.

Benefits of an acute pain service

POSTOPERATIVE PATIENT OUTCOME

Randomized controlled trials looking at the benefits or otherwise of APS have not been undertaken. However, there are data from studies of lower methodological quality that have attempted to compare pain relief and other patient outcomes in patients under the care of an APS with those patients who are not.

Although firm conclusions about the benefits of APS are difficult to make because of the heterogeneity of APS models, recent reviews have suggested that implementation of APS programs is associated with significant improvements in pain relief and reduction in the incidence of side effects after surgery.[34, 95, 98]

In the systematic review by Werner *et al.*,[95] 48 studies containing outcome data were identified. Twenty-five were prospective studies and of these, five were controlled trials (including one using historical controls) and ten analyzed outcome before and after provision of a formal APS. Twenty-three of the studies included in the review used retrospective data. The outcome variables most frequently reported were pain ratings, treatment-related side effects, and adverse events; less often the studies reported on postoperative complications, cost, and length

of hospital stay. In summary, the authors concluded that implementation of an APS is associated with a significant decrease in patients' postoperative pain ratings and that the incidence of nausea and vomiting may be reduced, but that evidence for other benefits is weak.

As Werner *et al*.[95] note in their paper, "segmenting the effects of an APS from the effects of the increased awareness of postoperative pain and/or improvements in postoperative pain techniques by multimodal pain-relieving techniques and improvements in surgical technique (minimal invasive surgery) is difficult." Outcome, such as postoperative morbidity and hospital stay, are dependent on many other factors in addition to good pain relief, including programs for postoperative care and rehabilitation, orders for mobilization and oral nutrition, and defined discharge criteria.

It could be argued that an APS "represents an instrument to improve pain relief"[95] and to assist in postoperative rehabilitation and fast-track surgery programs. It could also be argued that any improvement in pain is due to the analgesic technique used, the general increase in awareness of the importance of good pain management, the use and increasing availability of improved treatment regimens, and knowledge about and use of better treatment strategies for analgesia-related side effects, rather than the presence of the APS. However, widespread use of some more sophisticated techniques (e.g. epidural analgesia) in most institutions is only possible because of supervision by an APS.

There are some individual studies that show better outcome when use of a specific analgesic technique is supervised by an APS. For example, when a comparison was made between PCA managed by an APS or primary ward doctor, the incidence of postoperative nausea and urinary retention was less in APS-supervised patients, despite an increase in opioid consumption.[99] Similarly, the incidence of epidural-related hypotension decreased after the introduction of an APS[45, 100] and pain relief with PCA[45, 100] and epidural analgesia[45] improved. Input from an APS can also significantly improve the effectiveness of more traditional opioid analgesic administration.[48, 101]

Other individual studies showing marked improvements in pain relief with fewer side effects after the inception of an APS are those by Salomaki *et al*.[102] and a survey of 23 hospitals in the US, 49 percent of which had anesthesiologist-based APS.[103]

Improved patient outcomes in terms of decreased morbidity and mortality may also be seen if high-risk postoperative patients are regularly reviewed by a combined APS-critical care outreach team – see above under Models of APS organization.[90]

REDUCTION OF PERSISTENT PAIN

A number of studies have shown association between the intensity of acute pain (both postoperative and acute pain from medical conditions) and the development of persistent pain.[10, 104, 105, 106, 107, 108, 109] There is no evidence that treatment of acute pain, *per se*, will reduce the risk of persistent pain.[110] There is, however, some evidence that more aggressive acute pain relief with epidural analgesia started before surgery and continued after surgery under the supervision of an APS may reduce the incidence of persistent pain after thoracotomy[106, 111] and severe phantom pain after leg amputation,[112] although not the incidence of phantom pain overall.[113] Amitriptyline given in the early stages of acute herpes zoster may reduce the risk of chronic postherpetic neuralgia.[114] Members of an APS team may also be more likely to recognize the onset of early neuropathic pain associated with surgery, trauma, or medical disease, and institute appropriate treatment with antihyperalgesic drugs and techniques.[110]

ECONOMIC CONSIDERATIONS

Increasingly, healthcare decision-makers are using economic analyses to help allocate limited healthcare resources effectively. Unfortunately, as yet there are no good data about the cost-effectiveness of APS or the relative cost-effectiveness of the different models of APS, despite the rapid increase and widespread availability of APS in many countries (see above under The development and growth of acute pain services).

A recent review of economic evaluations[115] concluded that there was a lack of high-quality economic studies to support the cost-effectiveness and cost-benefits of APS, that the cost of APS for surgical patients from direct and indirect effects (improved pain management from education in patients not receiving APS) varied from US$2.28 to US$5.08 per patient per day, and that there were insufficient data to identify which APS model (anesthesiologist-based/nursing-supported or nurse-based/anesthesiologist-supervised) was more cost-effective. This cost is similar to that estimated more than a decade before by Breivik[116] – US$2–4 per patient per day for a nurse-based/anesthesiologist-supported APS.

Individual studies have, however, suggested that an APS may be cost-effective. In one of these,[51] a prospective evaluation of the cost-effectiveness of an APS-supervised multimodal epidural PCA program, an overall cost-saving was seen because of a shorter stay in the high-dependency wards, even though a greater degree of supervision was needed for the patient-controlled epidural analgesia (PCEA)-treated patients. The other study[58] looked at cost-effectiveness before and after the introduction of an APS; pain ratings and the incidence of postoperative complications (after some surgery) related to inadequate acute pain relief decreased, but there was no difference in duration of hospital stay and postoperative mortality rate. There was an increase in the cost per patient of 19 Euro per day.[58] While this is not an insignificant amount, it is a direct cost;

cost per patient per day would be less if indirect effects of an APS on all patients were taken into account.[116]

ORGANIZATION OF ACUTE PAIN SERVICES

Education

One of the reasons for past and current deficiencies in the management of acute pain is inadequate education of medical, nursing and allied health staff and students, patients and their families and friends. Inadequate knowledge, misconceptions, and the persistence of some of the myths that surround pain management continue to result in barriers that prevent optimal analgesia in many patients. Better education of all groups is needed, if more sophisticated methods of pain relief (such as patient-controlled and epidural analgesia) are to be managed safely and effectively and if better results are to be gained from conventional methods of pain relief.

PATIENTS

While the evidence for any benefit from preoperative patient education is varied and conflicting in terms of decreases in anxiety, analgesic use, and perceptions of pain intensity,[35, 117] it is only appropriate that patients who are cared for by the APS be given information about the pain relief methods that are available and the choices that they have. In order to make the decision on whether to consent to a treatment, they need the following information:

- likely benefits and the probabilities of success;
- risks and side effects;
- how their pain relief and its treatment (including any side effects or complications that may occur) will be monitored and assessed;
- a reminder that they can change their mind or have a second opinion;
- where applicable, details of costs or charges that have to be met.

Patients should know why effective analgesia is important for their recovery, as well as their comfort and the benefits of physiotherapy and early mobilization should be explained. Information should be given to each patient and tailored to the needs of that patient. It can be presented in a number of ways including verbally, in booklet form, on a video/CD, or made available on the Internet. Examples of the latter include:

- Australian and New Zealand College of Anaesthetists, Faculty of Pain Medicine:
  - Managing acute pain: a guide for patients (available from: www.anzca.edu.au/resources/books-and-publications);
- Royal College of Anaesthetists:
  - Epidurals for pain relief after surgery (available from: www.rcoa.ac.uk/docs/eprs.pdf);
  - Nerve damage associated with a spinal or epidural injection (available from: www.rcoa.ac.uk/docs/nerve-spinal.pdf).

The accuracy of some information available to patients remains limited, particularly in terms of risks associated with techniques, such as epidural analgesia. Past studies in this area, concentrating largely on epidural abscess formation,[118, 119, 120] suggested a complication rate between 1:800 and 1:10,000. However, more recent evidence from the UK,[121] and Australia[122] suggests an incidence of major complications (epidural abscess and hematoma) as high as 1:1030[122] to 1:660,[121] although not all patients suffered permanent neurological damage. Similar findings were reported from Sweden.[123] Clearly, this is one major task of an APS: to secure a robust monitoring regimen, to be able to discover early symptoms of impending major complications, and then treating them before irreparable damage can occur.[60, 124] The Third National Audit Project (NAP III) being undertaken by the Royal College of Anaesthetists is studying the complication rates associated with anesthetic and pain management neuraxial procedures. It is expected to report on its findings in late 2008.

When needed, patients should be given information at the time of discharge about ongoing pain relief at home, as well as, in the case of patients who have had epidural analgesia, the need to report back to the APS should they develop signs and symptoms that could suggest the onset of an epidural abscess. An example of a letter given to patients at the time of discharge is shown in **Box 47.1**.

NURSING AND MEDICAL STAFF

Ward nurses and medical staff play a key role in ensuring that analgesia, whether simple or sophisticated, is safely and effectively managed. It is known that improvements in the awareness and assessment of pain,[48, 94, 101] as well as improved postoperative pain relief and prescribing practices can result from staff education and the introduction of medical and nursing guidelines.[48, 101] Education and accreditation programs are therefore essential.

All medical and nursing personnel should be aware of the detrimental effects that unrelieved pain can have on patient well-being and outcome after trauma and surgery and understand the physiological and psychological benefits of good pain relief. They should have a good understanding of the techniques being used, potential problems including drug interactions, and the recognition and treatment of complications and side effects. They should also understand issues arising from the treatment of pain in cognitively impaired patients and in patients from different cultures.

Box 47.1 Example of letter given to patients after epidural analgesia

Postepidural infusion/injection patient instruction leaflet/discharge instructions

Serious complications from epidural analgesia are rare (1 in 10,000). Because the epidural space is close to the spinal cord a collection of pus, or a blood clot can cause pressure on the spinal cord. In the unlikely event that there is pressure on the spinal cord, it is crucial to diagnose and treat it as quickly as possible; this must be done by expert hospital doctors to prevent delays in treatment and long lasting damage. This leaflet tells you what to look for and what action to take if you think that you have a problem.

Assessment before the removal of epidural catheter

At the end of treatment with your epidural infusion, the team of doctors and nurses caring for you will examine you to ensure that you don't have any residual numbness or weakness of legs from the action of the drugs in your epidural infusion. They will ask to you move your legs and examine you to make sure that the sensation in your legs is as it was before the operation. It is important to remember that some operations can cause altered sensation in the legs, therefore any changes experienced may be as a result of the surgery and not the epidural. If you do have altered sensation when the epidural is removed, the attending team can discuss this with you.

If you experience any of the listed signs and symptoms (see list below) as a new problem, after your epidural infusion has been stopped as an inpatient ask the nurse in charge of the ward to contact the pain team or on call anaesthetist immediately.

If you have been discharged, it is important that you contact the on-call anaesthetist at the hospital immediately. After speaking to the on-call anaesthetist, they will arrange to see you in the Accident and Emergency department in order to examine you.

Signs and symptoms

- Redness, pus, tenderness, or pain at the epidural wound site;
- Feeling generally unwell, despite the fact that all seems to be well with the surgical wound;
- High temperature, neck stiffness;
- Numbness and or weakness in your legs/inability to weight bear;
- Difficulty passing water/incontinence of faeces.

Many APS require some form of certification or accreditation before nurses can assume responsibility for a patient using one of the more advanced methods of pain relief, such as PCA and epidural analgesia. Education and accreditation programs often consist of verbal and written information (e.g. lectures or workshops and booklets), written assessment (e.g. multiple choice questionnaires), and a practical assessment (e.g. demonstration of ability to program machines, administer epidural bolus doses).[72, 94] Reaccreditation every one to two years will help ensure that knowledge and practices are regularly updated. Formal education programs need to be supplemented with informal one-on-one bedside teaching in the ward.

Anesthesiologists and trainees involved with the APS must receive training and be made familiar with local guidelines. Teaching should be offered to medical students and doctors in training. It is important that surgeons and physicians at all grades of seniority are also offered continuing medical education in acute pain.

Selection of analgesic regimens

SELECTION OF ANALGESIC TECHNIQUE

The selection of analgesic techniques to be used by an APS is based on:

- availability of drugs, equipment, and expertise;
- risks and benefits of the drugs and techniques;
- operative procedure and associated risk factors, particularly size and location of primary incision;
- patient factors, particularly medical comorbidity.

The decision to offer a particular method of analgesia should be based on current knowledge of the benefits and limitations of the methods available, patient case mix, cultural differences, and staffing levels and training. In the first instance at least, it may be best to introduce just a small range of standard analgesic techniques, so that staff become knowledgable about and confident in their use.

A detailed discussion of analgesic techniques, including risks and benefits, is outside the scope of this chapter, but the range of methods that could be used by an APS includes:

- simple multimodal analgesia including paracetamol (acetaminophen), nonselective NSAIDs and COX-2-selective inhibitors in selected patients – see Chapter 4, Clinical pharmacology: traditional NSAIDs and selective COX-2 inhibitors, and Chapter 5, Clinical pharmacology: paracetamol and compound analgesics, in the *Acute Pain* volume of this series;
- optimized intermittent intravenous, intramuscular, subcutaneous, and oral opioid analgesia – see Chapter 3, Clinical pharmacology: opioids, in the *Acute Pain* volume of this series;
- patient-controlled i.v. opioid analgesia – see Chapter 11, Patient-controlled analgesia, in the *Acute Pain* volume of this series, and Chapter 24, Intravenous and subcutaneous patient-controlled analgesia;
- epidural analgesia, including patient-controlled epidural analgesia – see Chapter 13, Epidural and spinal analgesia, in the *Acute Pain* volume of this series, and Chapter 26, Epidural analgesia for acute pain after surgery and during labor, including patient-controlled epidural analgesia;
- single-dose intrathecal opioid analgesia – see Chapter 13, Epidural and spinal analgesia, in the *Acute Pain* volume of this series;
- continuous or intermittent regional blockade (other than epidural analgesia) – see Chapter 12, Continuous peripheral neural blockade for acute pain, in the *Acute Pain* volume of this series and Chapter 23, Peripheral nerve blocks: practical aspects;
- premixed nitrous oxide and oxygen (Entonox);
- treatments for neuropathic pain (including ketamine, antidepressants, anticonvulsants, and membrane stabilizers) – see Chapter 6, Clinical pharmacology: other adjuvants, in the *Acute Pain* volume of this series, and Chapter 12, Antiepileptics, antidepressants, and local anesthetic drugs;
- novel analgesic delivery systems, e.g. transdermal, iontophoretic transdermal, intranasal – see Chapter 10, Routes of administration, in the *Acute Pain* volume of this series, and Chapter 25, Alternative opioid patient-controlled analgesia delivery systems – transcutaneous, nasal, and others;
- nonpharmacological therapies, such as cognitive-behavioral approaches, hypnosis, relaxation exercises, and physical methods, such as transcutaneous electrical nerve stimulation (TENS), acupuncture, and massage – see Chapter 14, Transcutaneous electrical nerve stimulation (TENS) and acupuncture for acute pain; Chapter 16, Psychological interventions for acute pediatric pain; Chapter 15, Psychological therapies – adults, in the *Acute Pain* volume of this series; Chapter 17, Transcutaneous electrical nerve stimulation; and Chapter 18, Acupuncture.

While many APS still regard the care of patients receiving PCA, epidural analgesia including PCEA, single-dose spinal opioid analgesia, and continuous regional techniques as the bulk of their clinical work, it is inevitable that the use of more complex therapies in more complex patients will increase as the concept of a comprehensive, multidisciplinary inpatient pain service matures.

A number of factors will influence the appropriateness of a particular method of analgesia relating to the patient and to the planned surgical procedure. Although analgesic requirements vary from patient to patient, certain operative procedures are usually more painful than others. Thoracic and upper abdominal wounds tend to be the most painful. The anticipated severity and duration of pain will influence the choice of postoperative analgesia.

Patient factors are also very important and it is necessary therefore to take a careful history. The patient's underlying cardiovascular and respiratory status may influence the choice of analgesia. Certain analgesics may be inappropriate because of potential interactions with concomitant drug therapy or renal, hepatic, or endocrine disease. It is also important to ascertain the patient's past experience and expectations of pain relief and their preoperative use of opioids, alcohol, and other drugs, such as cannabis, cocaine, amphetamines, and benzodiazepines. Poor understanding or limited motor skills may limit the use of patient-controlled techniques. While making these assessments, it is possible to make some informal judgments of the patient's personality and coping style, which also help determine the most appropriate method of analgesia.

SELECTION OF EQUIPMENT AND DRUGS

The APS will require infusion pumps for the provision of PCA, epidural analgesia, continuous regional blockade, and the administration of drugs, such as ketamine. If continuous infusions are to be used, it may also be safer to use pumps where the rate of infusion can be capped (i.e. rate-limited), so that inadvertent high infusion rates cannot be delivered. Pumps used for epidural infusions and PCEA must have a high pressure tolerance to facilitate delivery of a bolus dose through the high resistance epidural filters and catheter without activation of the high pressure alarm.

The pumps used for PCA and for PCEA need to be portable and robust, easy to program, and lockable to prevent tampering with the program or reservoir. These lockable pumps may also be used to deliver continuous infusions of other drugs where diversion of that drug may be a risk (e.g. ketamine). The patient's PCA control button needs to be large enough to be easy to use and should have a retaining strap for less dexterous patients. In some circumstances, an alternative to a hand-held patient demand button may be needed (see Chapter 11,

Patient-controlled analgesia in the *Acute Pain* volume of this series). New developments in PCA technology may make cumbersome PCA pumps unnecessary for some patients, being replaced by adhesive iontophoretic PCA systems using transdermal fentanyl.[125, 126]

Although individualization of treatment is important, it is suggested that a limited number of drugs and drug regimens for pain relief is agreed within the hospital. The potential for error existing in a system where each anesthesiologist prescribes their own recipe for PCA, epidural analgesia, or single-dose intrathecal opioids is immense. Increasing evidence about optimal regimens of, for example, epidural analgesia[127] reduces the need for a wide variety of epidural analgesic combinations. Limiting the available regimens allows the hospital pharmacy to provide PCA syringes and infusion bags for epidural analgesia, allows the ward staff to become familiar with those techniques and their problems, and facilitates evaluation by the APS. Where possible, use of prefilled syringes or other drug reservoirs will minimize the risk of prescription errors and bacteriological contamination (see Chapter 26, Epidural analgesia for acute pain after surgery and during labor, including patient-controlled epidural analgesia).

Standardization of protocols and guidelines

Standard orders and guidelines are commonly used for the more advanced methods of pain relief such as PCA and epidural analgesia (see Chapter 11, Patient-controlled analgesia and Chapter 13, Epidural and spinal analgesia, in the *Acute Pain* volume of this series). However, standardization may also help to make traditional methods of pain relief, such as intermittent i.v. or i.m. opioid analgesia, safer and more effective.[48, 101, 124]

Consideration should therefore be given to standardizing a number of aspects of all acute pain management regimens, regardless of drug or technique used and regardless of whether the analgesia is considered simple or advanced.[72] These include:

- prescribing and documentation, for example:
  - drugs used (analgesic and nonanalgesic, e.g. for the treatment of nausea and vomiting);
  - drug doses and drug concentrations;
  - the use (if any) of concurrent anticoagulant and antiplatelet drugs and the timing of removal of epidural catheters in patients receiving such drugs;
  - nondrug treatment (e.g. supplemental oxygen).
- assessment of pain and the response to inadequate analgesia;
- monitoring for adverse effects and the response to and treatment of side effects.

As with all guidelines, the aim is to try and improve the quality of clinical decision-making and eliminate inappropriate/reduce unnecessary variations in clinical practice, not to dictate practice.

STANDARDIZED PRESCRIBING AND DOCUMENTATION

If the drugs and analgesic techniques can be agreed upon, charts can be preprinted with the standard regimen (some centers may use adhesive labels with preprinted drug concentrations), thus avoiding transcription errors. Similarly, guidance on alterations of doses, prohibition of other opioids or sedatives, use of supplemental oxygen, monitoring requirements, management of inadequate analgesia, recognition and treatment of side effects, and who to call if there are problems, can all be included in standardized orders. Examples of preprinted PCA and epidural analgesia standardized orders, which incorporate a bedside flow chart, are shown in **Figures 47.1** and **47.2**.

Standardized prescribing guidelines should not be limited to techniques such as PCA and epidural analgesia. An APS can help devise evidence-based guidelines for all analgesic regimens, advanced or simple, used for acute pain management.[72] See examples of APS-initiated guidelines for intermittent subcutaneous and oral opioid in **Figures 47.3** and **47.4**.

STANDARDIZED ASSESSMENT OF PAIN

The International Association for the Study of Pain defines pain as, "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage."[128] In other words, pain is a subjective, highly individual experience. Therefore, whenever possible, its assessment should be by the person experiencing the pain.

Correlations between observer and patient assessment of pain are usually low or moderate, even using specifically trained nursing staff with rationally derived rating scales.[129] Nurses consistently and significantly rate patients' pain lower than do the patients themselves.[130] However, patients think that nurses do know how much pain they are experiencing and this further impedes communication and treatment.

The assessment of pain (as the fifth vital sign) is therefore an essential component of acute pain management and should be a routine part of clinical practice, incorporated into standard nursing assessments and recorded in conjunction with assessments of respiration, blood pressure, pulse, and temperature measurements.

In the acute pain setting, unidimensional measures of pain intensity are most commonly used, such as the Visual Analog Scale, Verbal Numerical Rating Scale, and Categorical Rating Scale (using words to describe the pain). Each of these methods is reasonably reliable as long as any end points and adjectives employed are carefully selected and standardized. While often used to compare levels of pain between patients, these methods of scoring pain are

probably of most use as measures of change in the level of pain within each patient and the effectiveness of treatment of that pain. The use of pain scores and other methods of acute pain assessment are outlined in Chapter 2, Practical methods for pain intensity measurements and Chapter 8, Assessment, measurement, and history, in the *Acute Pain* volume of this series.

It can be very difficult to get a meaningful and totally subjective assessment of pain if the patient is acutely ill, disorientated, is cognitively impaired, or if there are language barriers to communication. Other methods of pain assessment will then be needed (see Chapter 8, Assessment, measurement, and history, in the *Acute Pain* volume of this series).

Whatever scale is used, it is important to assess pain intensity on movement as well as at rest, thus assessing dynamic analgesia. Assessing pain only at rest can easily give a false impression of comfort. It is important that patients are able to deep breathe and cough in the early postoperative period, to mobilize when required, and to participate in other rehabilitation activities. Pain relief can only be counted as fully effective if it allows the patient to perform these activities; if they cannot, then recovery will be impaired. Therefore an assessment of the functional impact of pain is useful.

One way of assessing and documenting this has been suggested – the Functional Activity Scale (FAS).[131] The possible scores are A, B, or C and the activity assessed is determined on an individual patient basis – for example, coughing may be an appropriate target after upper abdominal surgery, but joint mobility and ability to comply with physiotherapy an appropriate target after knee or hip replacement surgery.

Using this simple categorical score:

A = no limitation (there is no limitation of activity due to pain);
B = mild limitation (the patient is able to undertake the activity, but experiences moderate to severe pain);
C = significant limitation (the patient is unable to complete the activity due to pain).

It is also important to ensure that there is an adequate and timely response to inadequate analgesia or functional impairment. If patients are to gain maximum benefit from any techniques, then attention to detail is paramount as is the 24-hour availability of staff (medical and nursing), so that inadequate pain relief can be managed quickly.

STANDARDIZED MONITORING

Patients with acute pain must be assessed at frequent intervals in order to optimize analgesia and detect or manage side effects or complications at an early stage. Therefore, as well as regular assessments of pain, patients should also be observed for the onset of side effects and complications related to the analgesic technique in use.

Such assessments need to be done using clearly described and standardized criteria and tools. However, there will be little benefit from this unless these assessments are coupled with clearly defined trigger levels for intervention, and strategies need to be in place to manage deviation from expected values. Therefore, requirements for monitoring and documentation should be accompanied by guidelines for the recognition and treatment of adverse effects and complications. As well as orders for the treatment of common side effects, such as nausea and vomiting, itching and hypotension, there should be very clear guidelines that enable early recognition and treatment of respiratory depression and early recognition and notification of motor and sensory deficit or increasing back pain associated with epidural analgesia.

Respiratory depression

Fear of respiratory depression has limited the rational use of opioid analgesia by any route for many years. However, the incidence of respiratory depression after PCA and epidural analgesia is no higher than that seen with conventional as-needed intramuscular analgesia.[35]

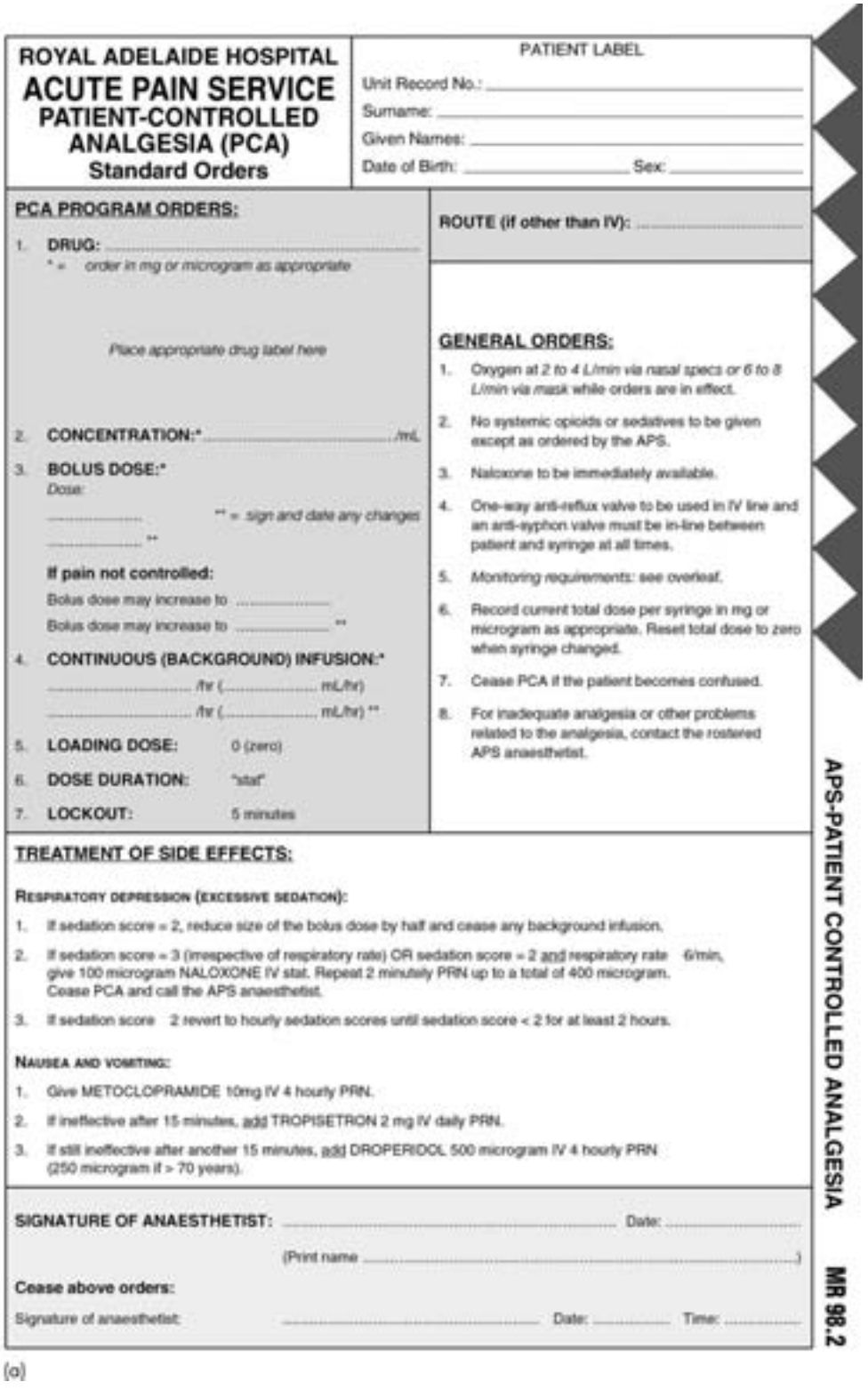
There remains significant confusion about the best method of monitoring for respiratory depression. Measurement of arterial pCO_2 levels is the most sensitive and accurate, but not possible in most patients, particularly on a regular basis. Therefore, reliance must be placed on clinical measures.

It is well known that respiratory rate is an unreliable guide to respiratory depression and hypoxemia;[35, 132] indeed, respiratory depression can coexist with a normal respiratory rate,[72] but that increasing sedation almost inevitably precedes significant respiratory depression. The patient's level of sedation should therefore be assessed on a regular basis. One common sedation scoring system used is that in **Table 47.1**. Note that it indicates that patients should be roused to assess their level of sedation. If this is not done, the early onset of respiratory depression can be missed, sometimes with fatal results.[133] If a sedation score of 2 or more is reported, a reduction in

Table 47.1 Sedation scores.

Score	Description
0	Wide awake
1	Easy to rouse[a]
2	Constantly drowsy, easy to rouse but unable to stay awake (e.g. falls asleep during conversation); early respiratory depression
3	Severe; somnolent, difficult to rouse; severe respiratory depression

[a]Some centers also add a "1S," which indicates asleep, but easy to rouse.



ROYAL ADELAIDE HOSPITAL
ACUTE PAIN SERVICE
PATIENT-CONTROLLED ANALGESIA (PCA)
Standard Orders

PATIENT LABEL
Unit Record No.: _____
Surname: _____
Given Names: _____
Date of Birth: _____ Sex: _____

PCA PROGRAM ORDERS:

1. **DRUG:** _____
   * = *order in mg or microgram as appropriate*

Place appropriate drug label here

2. **CONCENTRATION:*** _____ /mL
3. **BOLUS DOSE:***
   Dose:
   _____ ** = *sign and date any changes*
   _____ **
   If pain not controlled:
   Bolus dose may increase to _____
   Bolus dose may increase to _____ **
4. **CONTINUOUS (BACKGROUND) INFUSION:***
   _____ /hr (_____ mL/hr)
   _____ /hr (_____ mL/hr) **
5. **LOADING DOSE:** 0 (zero)
6. **DOSE DURATION:** "stat"
7. **LOCKOUT:** 5 minutes

ROUTE (if other than IV): _____

GENERAL ORDERS:

1. Oxygen at *2 to 4 L/min via nasal specs or 6 to 8 L/min via mask* while orders are in effect.
2. No systemic opioids or sedatives to be given except as ordered by the APS.
3. Naloxone to be immediately available.
4. One-way anti-reflux valve to be used in IV line and an anti-syphon valve must be in-line between patient and syringe at all times.
5. *Monitoring requirements:* see overleaf.
6. Record current total dose per syringe in mg or microgram as appropriate. Reset total dose to zero when syringe changed.
7. Cease PCA if the patient becomes confused.
8. For inadequate analgesia or other problems related to the analgesia, contact the rostered APS anaesthetist.

TREATMENT OF SIDE EFFECTS:

RESPIRATORY DEPRESSION (EXCESSIVE SEDATION):

1. If sedation score = 2, reduce size of the bolus dose by half and cease any background infusion.
2. If sedation score = 3 (irrespective of respiratory rate) OR sedation score = 2 and respiratory rate 6/min, give 100 microgram NALOXONE IV stat. Repeat 2 minutely PRN up to a total of 400 microgram. Cease PCA and call the APS anaesthetist.
3. If sedation score 2 revert to hourly sedation scores until sedation score < 2 for at least 2 hours.

NAUSEA AND VOMITING:

1. Give METOCLOPRAMIDE 10mg IV 4 hourly PRN.
2. If ineffective after 15 minutes, add TROPISETRON 2 mg IV daily PRN.
3. If still ineffective after another 15 minutes, add DROPERIDOL 500 microgram IV 4 hourly PRN (250 microgram if > 70 years).

SIGNATURE OF ANAESTHETIST: _____ Date: _____
(Print name _____)

Cease above orders:
Signature of anaesthetist: _____ Date: _____ Time: _____

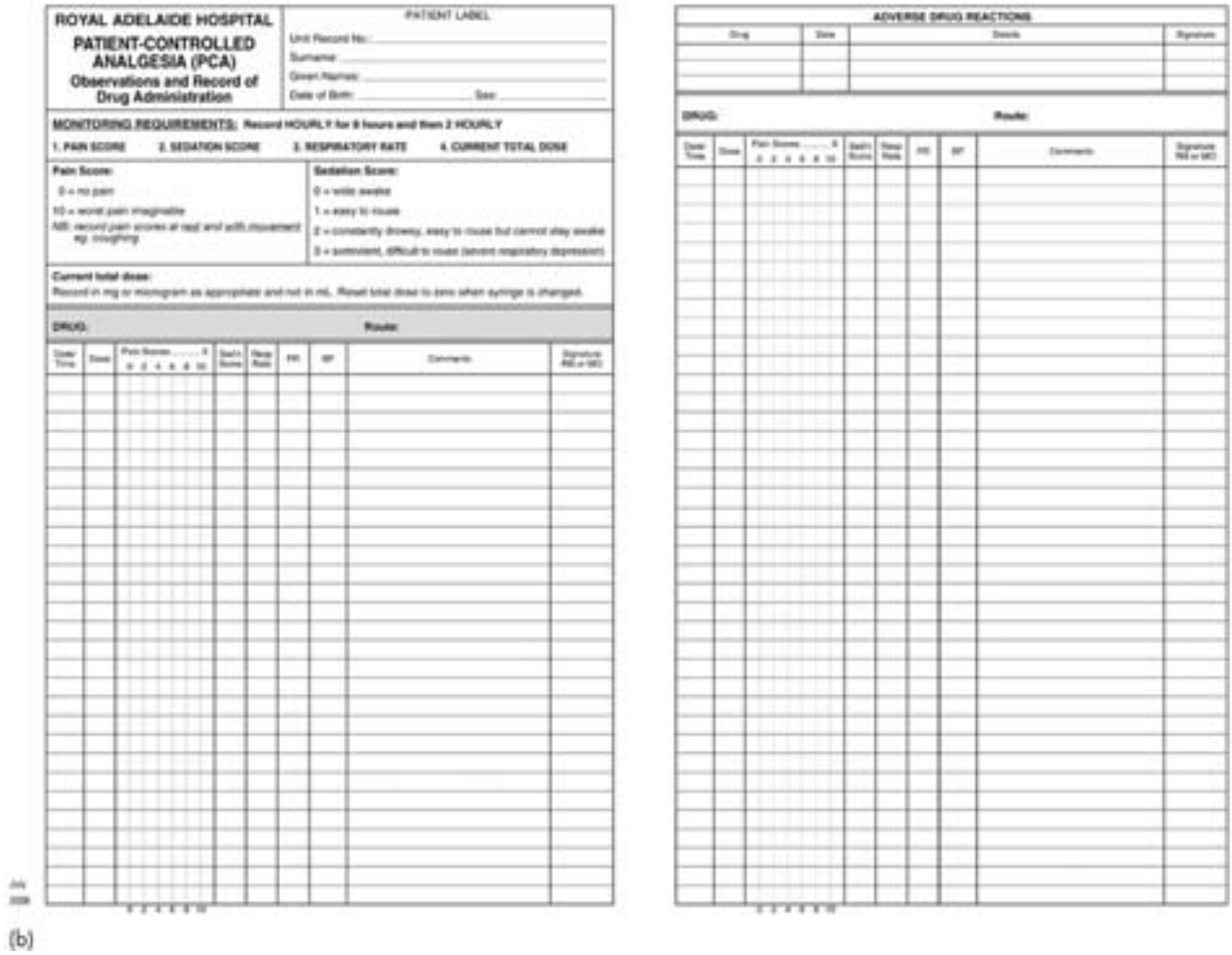
APS-PATIENT CONTROLLED ANALGESIA MR 98.2

(a)

Figure 47.1 Example of preprinted (a) standard orders (continued over). Reproduced with permission of the Royal Adelaide Hospital, South Australia.

opioid dose is mandated, regardless of the patient's pain score.[72] If the patient is uncomfortable, alternative and less sedating forms of pain relief need to be added to the analgesic regimen.

The importance of increasing sedation as a clinical sign of early respiratory depression was highlighted by Vila *et al.*[134] In an attempt to improve pain relief in a cancer setting they introduced a numerical pain treatment


ROYAL ADELAIDE HOSPITAL

PATIENT-CONTROLLED ANALGESIA (PCA)

Observations and Record of Drug Administration

PATIENT LABEL

Unit Record No.:

Surname:

Given Names:

Date of Birth: Sex:

MONITORING REQUIREMENTS: Record HOURLY for 6 hours and then 2 HOURLY

1. PAIN SCORE 2. SEDATION SCORE 3. RESPIRATORY RATE 4. CURRENT TOTAL DOSE

Pain Score:

0 = no pain

10 = worst pain imaginable

NB: record pain scores at rest and with movement eg. coughing

Sedation Score:

0 = wide awake

1 = easy to rouse

2 = constantly drowsy, easy to rouse but cannot stay awake

3 = somnolent, difficult to rouse (severe respiratory depression)

Current total dose:

Record in mg or microgram as appropriate and not in mL. Reset total dose to zero when syringe is changed.

DRUG: Route:

Date/ Time | Dose | Pain Scores ..... 0 2 4 6 8 10 | Sed'n Score | Resp. Rate | HR | BP | Comments | Signature RN or MO

ADVERSE DRUG REACTIONS

Drug | Date | Details | Signature

DRUG: Route:

Date/ Time | Dose | Pain Scores ..... 0 2 4 6 8 10 | Sed'n Score | Resp. Rate | HR | BP | Comments | Signature RN or MO

(b)

Figure 47.1 (b) Example of preprinted flow sheet for patient-controlled analgesia (continued).

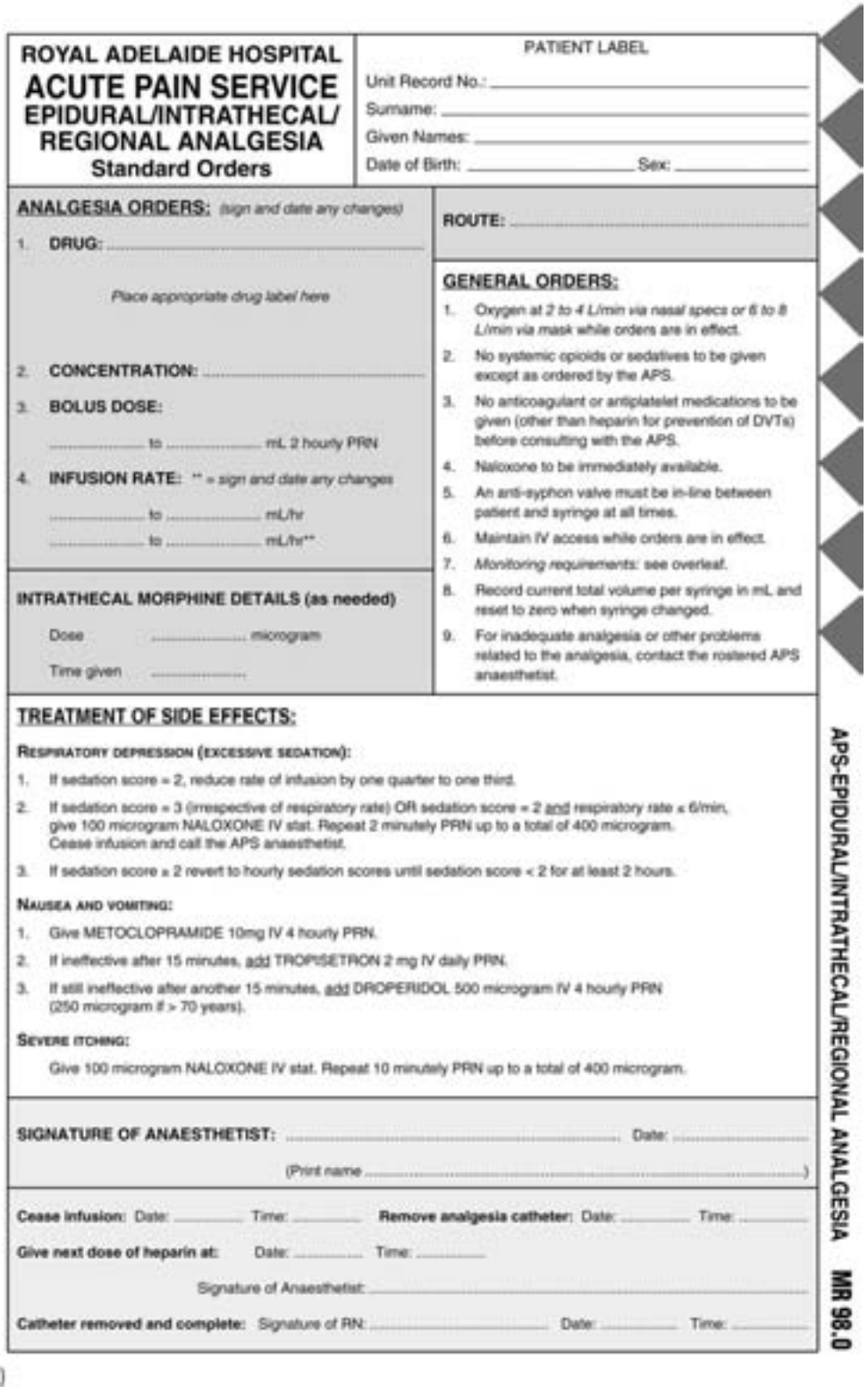
algorithm in which opioids were given to patients in order to achieve satisfactory pain scores. A review of this intervention showed a two-fold increase in the risk of respiratory depression. Importantly, the authors noted that respiratory depression was usually not accompanied by a decrease in respiratory rate. Of the 29 patients who developed respiratory depression (either before or after the introduction of the algorithm), only three had a respiratory rates of <12 breaths per minute, but 27 had a decrease in their level of consciousness. As well as confirming that increasing sedation is a more reliable way of detecting opioid-induced respiratory depression, this study highlighted the risk of titrating opioid (or other pharmacological therapies) solely to achieve a desirable pain score without appropriate patient monitoring.

Oxygen saturation (as measured by pulse oximetry) is often used as an easy and noninvasive measure of blood oxygen levels. However, care must be taken in the interpretation of any readings. If the patient is receiving supplemental oxygen, the added oxygen may mask deterioration in respiratory function (i.e. "normal" oxygen saturation levels may still be seen).

Hypotension

The reported incidence of hypotension associated with epidural analgesia varies widely[135] and depends on the dose of local anesthetic used and the criteria used to define hypotension. It can be minimized if appropriate dose regimens are used.[72, 124]

However, patients may become hypotensive in the hours following major surgery for many reasons. Unfortunately, if the patient is receiving epidural analgesia, the first response of the ward staff may be discontinuation of the epidural infusion, when the underlying cause is usually hypovolemia.[136] As a result, inadequate analgesia may be added to the patient's existing problems. In order to prevent this happening, a program of education should be introduced to all staff to help them differentiate between common causes of hypotension – for example, bleeding and relative hypovolemia in the presence of an epidural block.



ROYAL ADELAIDE HOSPITAL
ACUTE PAIN SERVICE
EPIDURAL/INTRATHECAL/ REGIONAL ANALGESIA
Standard Orders

PATIENT LABEL
Unit Record No.: _____
Surname: _____
Given Names: _____
Date of Birth: _____ Sex: _____

ANALGESIA ORDERS: *(sign and date any changes)*

1. **DRUG:** _____

Place appropriate drug label here

2. **CONCENTRATION:** _____
3. **BOLUS DOSE:**
_____ to _____ mL 2 hourly PRN
4. **INFUSION RATE:** ** = *sign and date any changes*
_____ to _____ mL/hr
_____ to _____ mL/hr**

ROUTE: _____

GENERAL ORDERS:

1. *Oxygen at 2 to 4 L/min via nasal specs or 6 to 8 L/min via mask while orders are in effect.*
2. No systemic opioids or sedatives to be given except as ordered by the APS.
3. No anticoagulant or antiplatelet medications to be given (other than heparin for prevention of DVTs) before consulting with the APS.
4. Naloxone to be immediately available.
5. An anti-syphon valve must be in-line between patient and syringe at all times.
6. Maintain IV access while orders are in effect.
7. *Monitoring requirements:* see overleaf.
8. Record current total volume per syringe in mL and reset to zero when syringe changed.
9. For inadequate analgesia or other problems related to the analgesia, contact the rostered APS anaesthetist.

INTRATHECAL MORPHINE DETAILS (as needed)

Dose _____ microgram
Time given _____

TREATMENT OF SIDE EFFECTS:

RESPIRATORY DEPRESSION (EXCESSIVE SEDATION):

1. If sedation score = 2, reduce rate of infusion by one quarter to one third.
2. If sedation score = 3 (irrespective of respiratory rate) OR sedation score = 2 and respiratory rate ≤ 6/min, give 100 microgram NALOXONE IV stat. Repeat 2 minutely PRN up to a total of 400 microgram. Cease infusion and call the APS anaesthetist.
3. If sedation score ≥ 2 revert to hourly sedation scores until sedation score < 2 for at least 2 hours.

NAUSEA AND VOMITING:

1. Give METOCLOPRAMIDE 10mg IV 4 hourly PRN.
2. If ineffective after 15 minutes, add TROPISETRON 2 mg IV daily PRN.
3. If still ineffective after another 15 minutes, add DROPERIDOL 500 microgram IV 4 hourly PRN (250 microgram if > 70 years).

SEVERE ITCHING:

Give 100 microgram NALOXONE IV stat. Repeat 10 minutely PRN up to a total of 400 microgram.

SIGNATURE OF ANAESTHETIST: _____ Date: _____
(Print name _____)

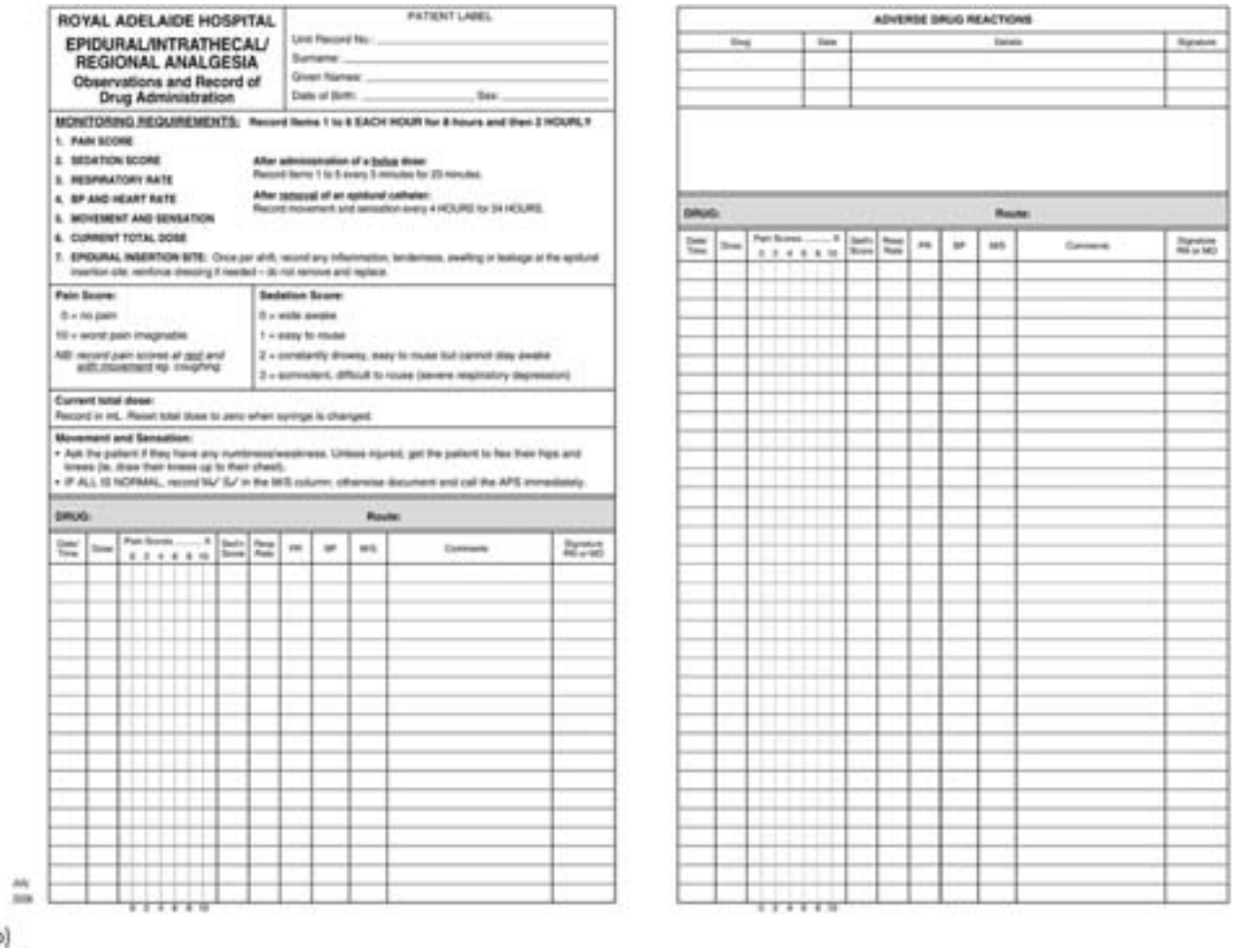
Cease infusion: Date: _____ Time: _____ **Remove analgesia catheter:** Date: _____ Time: _____
Give next dose of heparin at: Date: _____ Time: _____
Signature of Anaesthetist: _____
Catheter removed and complete: Signature of RN: _____ Date: _____ Time: _____

APS-EPIDURAL/INTRATHECAL/REGIONAL ANALGESIA **MR 98.0**

(a)

Figure 47.2 Example of preprinted (a) standard orders (continued over). Reproduced with permission of the Royal Adelaide Hospital, South Australia.

Recent studies have suggested a benefit from moderate fluid restriction during and after some major surgical procedures.[137, 138, 139] After colorectal surgery, Brandstrup *et al.*[138] found that a restricted regimen aimed at maintaining perioperative body weight resulted in significant decreases in cardiorespiratory and tissue healing complications. Similarly, Holte *et al.*[139] reported an improvement in pulmonary function – although it was


ROYAL ADELAIDE HOSPITAL

EPIDURAL/INTRATHECAL/ REGIONAL ANALGESIA

Observations and Record of Drug Administration

PATIENT LABEL

Unit Record No.:

Surname:

Given Names:

Date of Birth: Sex:

MONITORING REQUIREMENTS: Record items 1 to 6 EACH HOUR for 8 hours and then 2 HOURLY

1. PAIN SCORE
2. SEDATION SCORE
3. RESPIRATORY RATE
4. BP AND HEART RATE
5. MOVEMENT AND SENSATION
6. CURRENT TOTAL DOSE
7. EPIDURAL INSERTION SITE: Once per shift, record any inflammation, tenderness, swelling or leakage at the epidural insertion site; reinforce dressing if needed – do not remove and replace.

After administration of a bolus dose: Record items 1 to 5 every 5 minutes for 20 minutes.

After removal of an epidural catheter: Record movement and sensation every 4 HOURS for 24 HOURS.

Pain Score:
0 = no pain
10 = worst pain imaginable
NB: record pain scores at rest and with movement eg. coughing

Sedation Score:
0 = wide awake
1 = easy to rouse
2 = constantly drowsy, easy to rouse but cannot stay awake
3 = somnolent, difficult to rouse (severe respiratory depression)

Current total dose:
Record in mL. Reset total dose to zero when syringe is changed.

Movement and Sensation:
- Ask the patient if they have any numbness/weakness. Unless injured, get the patient to flex their hips and knees (ie. draw their knees up to their chest).
- IF ALL IS NORMAL, record 'M✓ S✓' in the M/S column; otherwise document and call the APS immediately.

DRUG: Route:

Date/ Time	Dose	Pain Scores ..... R 0 2 4 6 8 10	Sed'n Score	Resp Rate	HR	BP	M/S	Comments	Signature RN or MO

ADVERSE DRUG REACTIONS

Drug	Date	Details	Signature

DRUG: Route:

Date/ Time	Dose	Pain Scores ..... R 0 2 4 6 8 10	Sed'n Score	Resp Rate	HR	BP	M/S	Comments	Signature RN or MO

(b)

Figure 47.2 (b) Example of preprinted flow sheet for patient-controlled analgesia (continued).

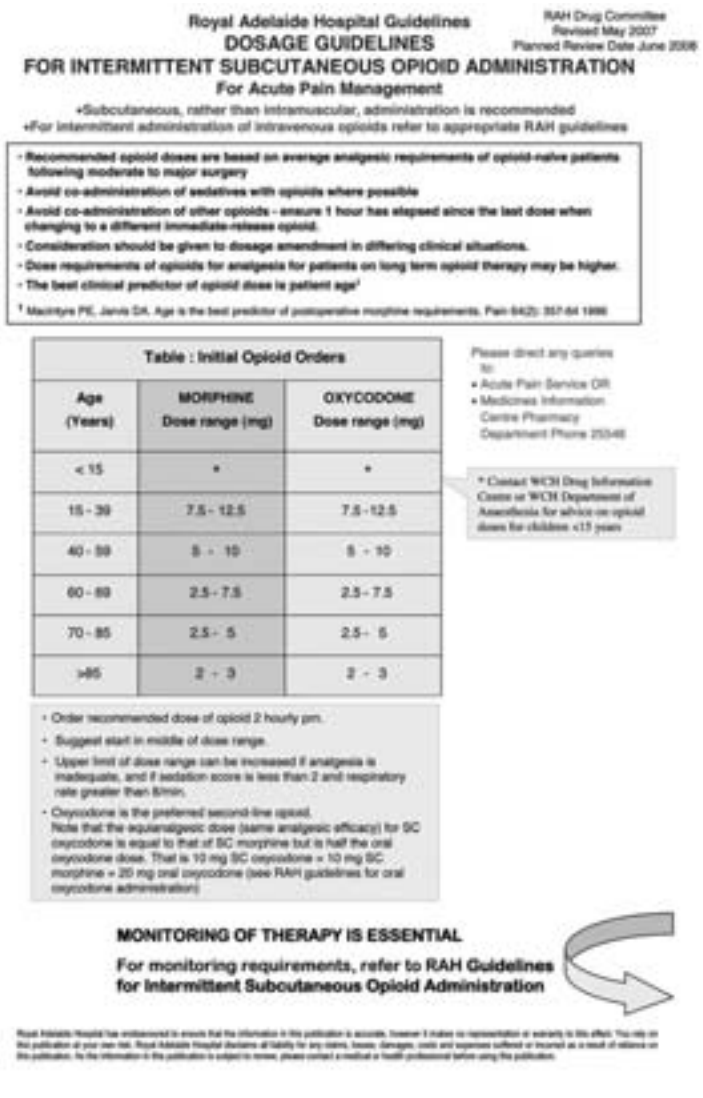
only transient (differences in forced vital capacity (FVC) and forced expiratory volume (FEV) were significant at six hours after surgery only); there was an increase in the concentrations of cardiovascularly active stress response hormones (renin, aldosterone, and angiotensin) and no differences in the rate of overall recovery.

Adherence to restrictive regimens could further complicate the provision of epidural analgesia and may increase the need for vasoconstrictor use, which may not always be to the patient's benefit. The perioperative period is extremely complex and the studies regarding fluid restriction to date seldom make allowance for conflicting issues such as the quality of analgesia, which might also influence outcome; thus the case for such regimens is not yet proven.[140] That said, Holte *et al.*[139] expressed some concern about the trend to more anastomosis leakages in the patients on restrictive regimens, so their suggestion that individualized goal-directed fluid administration strategies (which could take into account the use of epidural analgesia) may be the sensible way forward.

Motor and sensory blockade and block height

A major concern about the use of epidural analgesia is the risk of spinal cord compression and paraplegia from an epidural hematoma or abscess. Although the risk is low (see above under Organization of acute pain services), early detection is the key to avoiding permanent neurological loss. Early diagnosis and, if indicated, immediate surgical decompression, will increase the likelihood of good neurological recovery.[141] Ideally, this will occur within eight hours of the onset of neurological symptoms, but even then the degree of residual damage is determined by the degree of compression and a complete recovery is not assured.

It is therefore important to use epidural regimens (drug doses and infusion rates) that minimize (ideally avoid) motor and sensory deficit (see Chapter 26, Epidural analgesia for acute pain after surgery and during labor, including patient-controlled epidural analgesia). As well as maximizing the chance of the development of an abscess or hematoma being diagnosed at an early stage, it



Royal Adelaide Hospital Guidelines

RAH Drug Committee
Revised May 2007
Planned Review Date June 2009

DOSAGE GUIDELINES

FOR INTERMITTENT SUBCUTANEOUS OPIOID ADMINISTRATION

For Acute Pain Management

•Subcutaneous, rather than intramuscular, administration is recommended
•For intermittent administration of intravenous opioids refer to appropriate RAH guidelines

- **Recommended opioid doses are based on average analgesic requirements of opioid-naive patients following moderate to major surgery**
- **Avoid co-administration of sedatives with opioids where possible**
- **Avoid co-administration of other opioids - ensure 1 hour has elapsed since the last dose when changing to a different immediate-release opioid.**
- **Consideration should be given to dosage amendment in differing clinical situations.**
- **Dose requirements of opioids for analgesia for patients on long term opioid therapy may be higher.**
- **The best clinical predictor of opioid dose is patient age[1]**

[1] MacIntyre PE, Jarvis DA. Age is the best predictor of postoperative morphine requirements. Pain 64(2): 357-64 1996

Table : Initial Opioid Orders

Age (Years)	MORPHINE Dose range (mg)	OXYCODONE Dose range (mg)
< 15	*	*
15 - 39	7.5 - 12.5	7.5 - 12.5
40 - 59	5 - 10	5 - 10
60 - 69	2.5 - 7.5	2.5 - 7.5
70 - 85	2.5 - 5	2.5 - 5
>85	2 - 3	2 - 3

Please direct any queries to:
- Acute Pain Service OR
- Medicines Information Centre Pharmacy Department Phone 25348

* Contact WCH Drug Information Centre or WCH Department of Anaesthesia for advice on opioid doses for children <15 years

- Order recommended dose of opioid 2 hourly prn.
- Suggest start in middle of dose range.
- Upper limit of dose range can be increased if analgesia is inadequate, and if sedation score is less than 2 and respiratory rate greater than 8/min.
- Oxycodone is the preferred second-line opioid. Note that the equianalgesic dose (same analgesic efficacy) for SC oxycodone is equal to that of SC morphine but is half the oral oxycodone dose. That is 10 mg SC oxycodone = 10 mg SC morphine = 20 mg oral oxycodone (see RAH guidelines for oral oxycodone administration)

MONITORING OF THERAPY IS ESSENTIAL

For monitoring requirements, refer to RAH Guidelines for Intermittent Subcutaneous Opioid Administration

(a)

Figure 47.3 Example of guidelines for intermittent subcutaneous opioids administration (continued over). Reproduced with permission of the Royal Adelaide Hospital, South Australia.

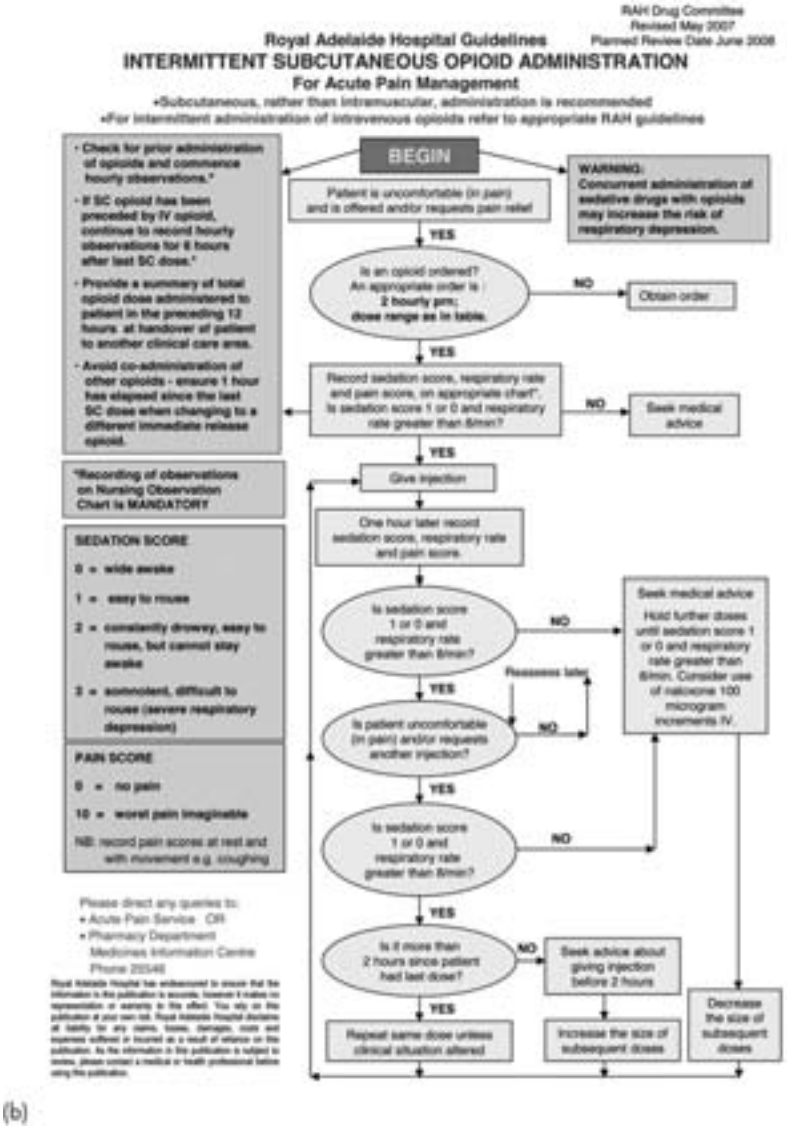
will also help maximize the patient's ability to move and walk (both proprioception and muscle strength will be preserved) and reduce the risk of hypotension. Note that a patient with an epidural abscess may not be febrile.[35]

Also importantly, patients must be reminded (and ideally given written information prior to discharge – see example in **Box 47.1**) that they should contact the APS urgently should they develop increasing (new) back pain or motor or sensory loss after they have left hospital. Signs and symptoms of epidural abscesses may not develop until some time after discharge.[122]

Neurological deterioration in any patient with, or having recently had, an epidural catheter in place should prompt urgent radiological investigation to exclude treatable cord compression. If a patient with epidural analgesia develops motor or significant sensory block of one or both limbs, it is important to exclude the presence of epidural hematoma or abscess, or inadvertent subarachnoid infusion, by switching off the infusion and reassessing the patient regularly over the next one to three hours for signs of resolution of the blockade. Failure of the block to resolve should prompt early investigation by magnetic resonance (MR) (preferably) or computed tomography (CT) scan.

It is therefore essential that sensory and motor function should be tested informally (by inquiring if the patient has any numbness and asking them to flex their hip: movement at ankle or toes only is not sufficient[72] or formally (using a recognized scale such as that suggested by Bromage[142]) on a regular basis. Testing should be performed both during the time of epidural analgesia and for a period after removal of the epidural catheter. One should be aware that epidural hematoma and abscess may occur subsequent to the removal of the catheter or even several days later.

Regular monitoring of the level of block during epidural analgesia has been common practice in many hospitals with a block level above T4 mandating reductions in epidural infusion rates. However, in modern practice with epidural catheters sited at the upper dermatome for abdominal and



(b)

Figure 47.3 Example of guidelines for intermittent subcutaneous opioids administration. Reproduced with permission of the Royal Adelaide Hospital, South Australia (continued).

thoracic surgery, block levels above T4 are common and should not be cause for concern in the absence of motor loss or significant hypotension or bradycardia. Experience in cardiac surgery, with blocks routinely sited at T4, have demonstrated that respiratory function is maintained even in the presence of demonstrable loss of power and paresthesia in the upper limbs leading to monitoring systems based on arm power in different myotomes.[143] This should not be necessary in noncardiac surgery, but suggests that monitoring for arm symptoms is adequate in everyday practice, rather than assessing the formal level of block which becomes increasingly unreliable the weaker the local anesthetic used. In some centers, routine observations of bilateral upper and lower sensory level for cold (ice-cube in a glove) is done by nurses on the ward, in order to assist in the earlier detection of a dislodged epidural catheter (see Chapter 26, Epidural analgesia for acute pain after surgery and during labor, including patient-controlled epidural analgesia).[124]

Back pain

Patients should also be asked if they have any back pain as increasing (and new) back pain may be the first sign of an epidural hematoma or abscess following epidural analgesia.[35]

Audit and quality improvement

The delivery of an APS is a high-volume activity and patient safety is paramount. Errors occur and may have serious implications, but understanding the causes of errors are an important way of preventing repeat occurrences. Critical analysis of errors can be used to initiate changes in patient care, equipment, and organization of the APS.[144] Efforts to improve pain management therefore involve much more than just improving pain assessment and documentation, and an APS should include the use of evidence-based treatment regimens,

RAH Drug Committee
Revised August 2006
Planned Review Date August 2007

Royal Adelaide Hospital Guidelines

DOSAGE GUIDELINES FOR INTERMITTENT IMMEDIATE-RELEASE ORAL OXYCODONE ADMINISTRATION

For Acute Pain Management

- Recommended opioid doses are based on average analgesic requirements of opioid-naïve patients following moderate to major surgery
- Avoid co-administration of sedatives with opioids where possible
- Avoid co-administration of other opioids (eg morphine, hydromorphone, Panadeine Forte) – ensure 1 hour has elapsed since the last dose when changing to a different immediate-release opioid.
- Consideration should be given to dosage amendment in differing clinical situations.
- Dose requirements of opioids for analgesia for patients on long term opioid therapy may be higher.
- The best clinical predictor of opioid dose is patient age[†]
- Slow-release oxycodone (Oxycontin) is not recommended for management of acute pain. At the RAH, patients can only be commenced on Oxycontin by the Pain Management, Palliative Care or Cancer Services

[†] Macintyre PE, Jarvis DA. Age is the best predictor of postoperative morphine requirements. Pain 64(2): 357-64 1996

Table : Initial Immediate-release Oral Oxycodone Orders

Age (Years)	Oxycodone Dose range (mg)
< 15	*
15 - 39	15 - 25
40 - 59	10 – 20
60 - 69	5 – 15
70 - 85	5 – 10
> 85	2.5 - 5

Please direct any queries to:
- Acute Pain Service OR
- Medicines Information Centre Pharmacy Department Phone 25546

* Contact WCH Drug Information Centre or WCH Department of Anaesthesia for advice on opioid doses for children <15 years

- Order recommended dose of oxycodone 2 hourly prn.
- Suggest start in middle of dose range.
- Upper limit of dose range can be increased if analgesia is inadequate, and if sedation score is less than 2 and respiratory rate greater than 8/min.

Use of Oxycodone as a discharge medication

- Oxycodone is not recommended for routine prescription on discharge
- If it is to be prescribed, both the patient and the patient's general practitioner should be informed that it is recommended that it be used only for a maximum of a week after discharge and in decreasing daily doses. Re-prescription is not recommended. If the patient's pain persists they should be reviewed.

MONITORING OF THERAPY IS ESSENTIAL

For monitoring requirements, refer to RAH Guidelines for Intermittent Oral Oxycodone Administration

(a)

Figure 47.4 Example of guidelines for intermittent oral oxycodone (continued over). Reproduced with permission of the Royal Adelaide Hospital, South Australia.

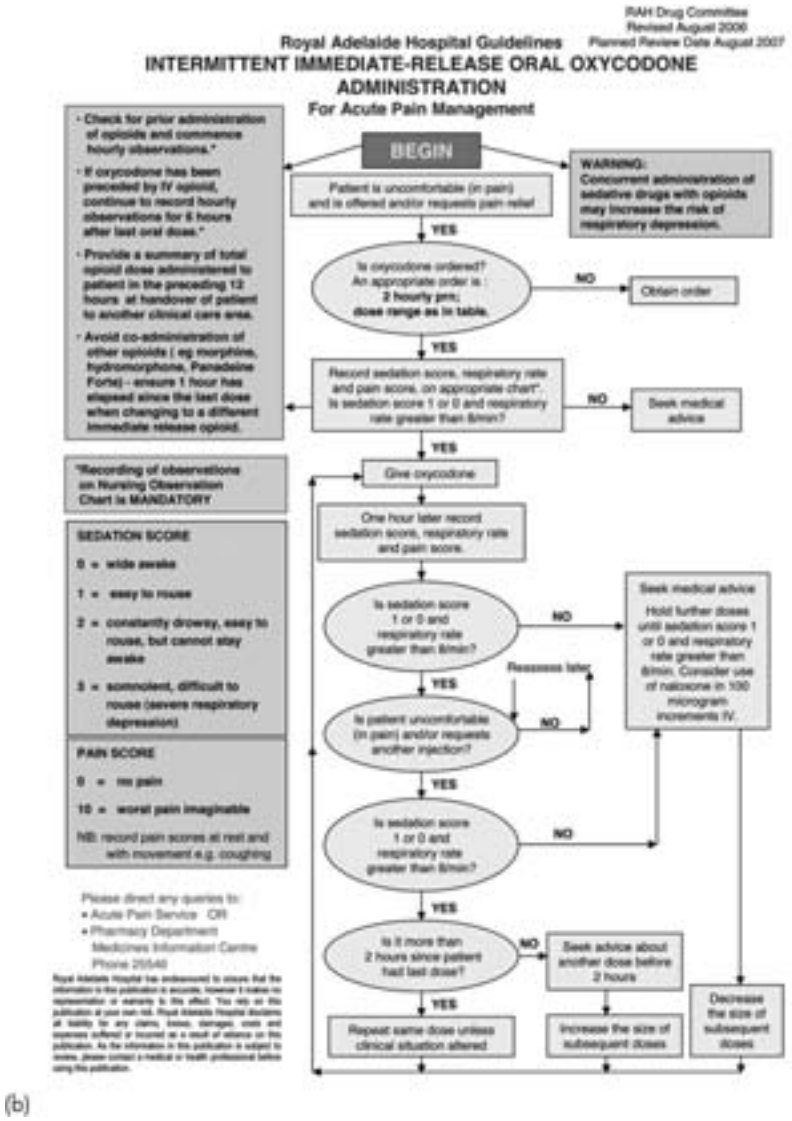
pain management quality improvement (QI) measures, and increased patient involvement.[145]

Traditionally, three aspects of an APS can be audited:

1. **Outcome** – patient satisfaction, analgesic efficacy, side effects (e.g. emesis, pruritus), critical incidents, length of hospital stay, complications, mobilization, bowel and bladder function;
2. **Structure** – staff, equipment;
3. **Process** – patients (e.g. number, origin, age, surgical procedure), techniques (e.g. type, duration, drug, failure rate), service (e.g. response times, missed follow up), documentation (e.g. pain, side effects).

Recommended quality indicators and suggested measures for acute pain management have been published by the American Pain Society[145] and the Royal College of Anaesthetists.[146]

The key to effective QI is the cycle whereby audit information is collected, analyzed, and reviewed; changes are then agreed and standards set; the changes are implemented; and after a period of time the cycle repeated. Institutional barriers to this labor-intensive QI approach must be addressed in order for this process to be effective. Such barriers include lack of administrative support and resources for data collection, analysis, and review of changes needed; a reliance on written information rather than face-to-face information and education sessions with staff in order to facilitate implementation of change; and resistance to change (see Chapter 48, Acute pain services and organizational change).[145] Gordon *et al.*[145] also highlight the critical role of physician leadership in QI programs and change, rather than just physician involvement, and that an interdisciplinary team approach is essential to change as an individual person or discipline acting alone often fails to achieve the desired outcomes.



(b)

Figure 47.4 Example of guidelines for intermittent oral oxycodone. Reproduced with permission of the Royal Adelaide Hospital, South Australia (continued).

Regular audit of the activity and outcomes of an APS will allow appropriate review and adjustment of management protocols and continuing staff education. However, this requires a reliable method of data collection.

In recent years, the use of personal digital assistants (PDA) on APS rounds has become increasingly common.[147, 148, 149, 150] Chan *et al.*[148] compared a PDA-based data management system with their previous paper system, looking at factors such as ease of use, the time taken to conduct the APS round, and the amount of paper saved. While they found no difference in user satisfaction, there was a significant saving in paper and man-hours with the PDA system. Lee *et al.*[147] also reported that a PDA system resulted in much faster data management.

It is very difficult to maintain interest in reporting and to achieve any degree of completeness over long periods of time. Reporting procedures need to be available, simple, confidential, involve feedback, and result in effective changes. An enthusiastic and vigilant coordinator is essential.

Communication and collaboration

Within each institution there must be clearly defined lines of communication and accountability for acute pain management.[145] Communication between the acute pain team and the varied departments accommodating patients is vitally important and can be facilitated by the designation of nurse unit teachers or link nurses. These can be involved in regular meetings with the APS and be responsible for the two-way dissemination of information between the APS and their clinical areas. The members of the APS team should also meet regularly to review problems and progress and to revise management strategies as needed. Surgeons and physicians responsible for other

clinical areas and administrative, medical, and nursing managers need to be kept abreast of the APS developments through meetings and reports.

In addition, and in view of the complexity (medical comorbidities and/or pain issues) of patients often seen by an APS and the likelihood of shared care of a patient, members of the APS team will need to communicate and collaborate with members of other medical and nursing services. This may include, but is not limited to, chronic pain clinics, palliative care services, and drug and alcoholic services.

Arrangements for cover out of normal hours should be detailed in the APS documentation and all staff made aware of these. Different disciplines may be responsible for different aspects of the service and lines of communication and continuity of care need to be clearly delineated. This is also true for the relationship with and responsibility for any chronic pain inpatients and for other shared patients. Therapy commenced during the inpatient phase of treatment is often aimed at dealing with the immediate problem to facilitate discharge; mechanisms to ensure appropriate follow up of these patients is essential.

CONCLUSIONS

Acute pain services are essential to the organization of care for patients who have acute pain following surgery, trauma, or medical conditions. Their introduction has led to improved pain relief as a result of a multidisciplinary approach to education, training, and assessment and the safe introduction of more effective methods of analgesia.

The role of an APS has changed significantly since the first APS was implemented. APS teams now commonly manage more complex pain problems and acute pain in increasingly more complex patients. APS can also play a significant role in admission planning by taking an active part in preoperative assessment – not just in terms of patient education and explanations about acute pain management, but also in identifying those patients who have high predictors for the risk of developing persistent postsurgical pain or with more complex comorbidities such as opioid tolerance, substance abuse disorders, or chronic pain.

Although the early emphasis on acute pain management alone was essential, experience over the last 20 years has resulted in an increased awareness of two features of treating this particular (acute pain) patient population that would be improved by integration with other clinicians and other clinical services.

The first is that treatment of pain *per se* will not necessarily improve surgical outcome and that analgesia should not be considered in isolation but as a component of a multimodal clinical pathways approach to perioperative care to facilitate rehabilitation and recovery.[2]

Second, separation of APS teams from existing CPS may result in a simplistic approach to pain relief, emphasizing the treatment of the nociceptive element of postoperative pain. This may result in the underdiagnosis and undertreatment of neuropathic pain occurring in the early postinjury period, with the subsequent development of chronic pain states and referral to CPS. In addition, this artificial distinction between the two types of services may lead to suboptimal management of patients presenting at the interface of acute and chronic pain management.

One possibility in the future is that pain services are defined as inpatient and outpatient, rather than APS and CPS to ensure appropriate resources for both arms of the service whilst recognizing that pain has few, if any, artificial boundaries and that a comprehensive approach to pain is required in both circumstances. Whatever nomenclature is used, services must be structured to allow flow between inpatient and outpatient services and the training of medical and nursing staff must reflect the wider range of skills and knowledge required by inpatient clinicians beyond the traditional need to manage only acute pain.

In addition to the need to ensure the development of a comprehensive integrated pain service, one must not forget the needs of perioperative patients and the need to integrate pain management strategies with other overlapping issues, such as postoperative nausea and vomiting, thromboprophylaxis, fluid and electrolyte management, control of blood pressure, sepsis, and hypoxemia and other respiratory complications. The importance of the expertise gained by the members of APS and their role in perioperative medicine, as part of a fast-track team, and in the development of critical care outreach teams is to be encouraged.

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