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Preparation of patients for anaesthesia—achieving quality care

為病人進行麻醉前的準備——質素護理的實踐

Implementation of anaesthesia begins with a preoperative assessment of the surgical patient and development of an anaesthetic plan. Preparation of the patient includes the preoperative assessment, review of preoperative tests, optimisation of medical conditions, adequate preoperative fasting, appropriate premedication, and the explanation of anaesthetic risk to patients. The goals of preoperative preparation are to reduce the morbidity of surgery, to increase the quality while decreasing the cost of perioperative care, and to return the patient to desirable functioning as quickly as possible. A knowledgeable anaesthesiologist is the 'final clinical gatekeeper', who coordinates perioperative management and ensures that the patient is in the optimal state for anaesthesia and surgery.

麻醉的實施開始於手術前對病人的術前評估和麻醉計劃的製定。對病人的準備包括術前評估、術前測試回顧、醫藥條件優化、充分的術前禁食、適當的術前用藥、及對病人解釋麻醉風險。術前準備的目的是減少手術引起的不正常病態，提昇手術質素並減少手術前後護理的費用，及儘快使病人恢復原有身體機能。有見識的麻醉科醫生是「最後的臨床把關人」，負責協調手術前後的處理及保證病人處於麻醉和手術的最佳狀態。

Introduction

Implementation of anaesthesia begins with a preoperative assessment of the surgical patient and the development of an anaesthetic plan.¹ It is essential to perform preoperative assessment, and guidelines for preoperative consultation have been formulated.²

A recent survey showed that in the local public hospital service, more than 96% of patients undergoing surgical procedures requiring anaesthetic service were assessed preoperatively (Table).³ The purpose of the assessment is to ensure that the patient is in the optimal state for anaesthesia and surgery. The study by Kluger et al⁴ documented the important link between poor preoperative preparation and morbidity/mortality.

Anaesthetic preparation of a patient includes preoperative assessment and optimisation, review of preoperative tests, adequate preoperative fasting, appropriate premedication, and the explanation of anaesthetic risks to patients.

Preoperative preparation

Preoperative assessment

Organisation of the preoperative assessment

Organisation of the preoperative assessment varies among different anaesthetic facilities. The assessment process can be organised with a visit to the out-patient

Table. Summary statistics for anaesthetic clinical indicators—patients having preoperative visit

Anaesthetic clinical indicators	No. of public hospitals	Mean % (95% CI)
Elective surgery	23	98.83 (94.24-99.42)
Emergency surgery	20	96.28 (94.60-97.96)

Key words:

Anesthesia;
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preoperative assessment clinic, a preoperative visit in the in-patient ward prior to the day of surgery; or by a telephone interview/health questionnaire, with a preoperative assessment on the day of surgery.⁵

The traditional practice of anaesthetic assessment the evening before the procedure is now diminishing due to inadequate time for preparation. When a patient is admitted on the same day of operation, in some anaesthetic facilities the anaesthesiologist performs assessment immediately prior to the scheduled procedure. For those patients presenting with complex medical conditions, this does not allow sufficient time for review of repeated tests or re-assessment after medical treatment.⁶ Assessment in a preoperative anaesthetic clinic has been shown to minimise surgical delays and cancellations on the day of operations, as well as achieving more efficient use of hospital beds and operating room time.⁷

One disadvantage of assessment in a preoperative anaesthetic clinic is that the attending anaesthesiologist frequently is not the person responsible for intra-operative anaesthetic management.⁸ Adequate communication and efficient hospital procedures are necessary to provide continuous patient care. Efficiency may be increased with improved teamwork if clinical guidelines for patient assessment are practised.⁹ The preoperative anaesthetic clinic enhances patient awareness of the role of the anaesthesiologist as a perioperative physician, in both a professional and a public sense.¹⁰

Goals of preoperative assessment

The purposes of preoperative assessment of the surgical patient are to:

- (1) identify the patient and confirm with him/her (or their guardian) the nature of the procedure;
- (2) perform clinical assessments, including review of medical records and charts; review of laboratory tests; plan for stabilisation of medical conditions in order to optimise perioperative outcome; consult colleagues in other disciplines where appropriate, eg cardiologist;
- (3) obtain informed consent for anaesthesia, after discussing the anaesthetic plan and relevant risks with the patient; identify high-risk conditions for which pre-anaesthesia reassessment and/or stabilisation are required prior to the induction of anaesthesia;
- (4) educate the patient about anaesthesia, provide information and instructions for perioperative care and pain management to facilitate recovery; and
- (5) reduce patient anxiety and prescribe premedication if necessary.

Identification of high anaesthetic risk

The identification of medical conditions with a high risk of anaesthetic complications, and preoperative medical optimisation, significantly reduces the rate of complications.¹¹ Conditions include those associated with potential cardiovascular instability such as a history of unstable

angina, recent myocardial infarction, congestive heart failure, uncontrolled hypertension (systolic blood pressure >150 mm Hg, diastolic blood pressure >90 mm Hg); respiratory conditions such as steroid-dependent asthma, severe chronic obstructive pulmonary disease, and upper or lower airway obstruction; and endocrine disorders such as diabetes mellitus, active thyroid disease, or adrenal disorders.⁷ Those patients deemed to be at very high risk are admitted to hospital the day before surgery, and may even be admitted to the High Dependency Unit for protocol-based preoptimisation.¹²

Conduct of history taking and physical examination

A properly conducted history taking and physical examination should involve establishing rapport and gaining the trust of the patient, especially when exploring sensitive areas such as the possibility of pregnancy in a minor, the potential for acquired immunodeficiency syndrome, or a history of psychiatric illness. A detailed assessment of current medical problems and review of current medications, including illicit drug use and allergic history, should be undertaken.

A systematic review of organ functions is an essential part of assessment, in order to identify the possible end-organ damage of existing medical conditions.

Prior anaesthetic history and any anticipated difficult intubation should be noted. No one factor is shown to predict difficult intubation.¹³ A careful upper airway assessment includes testing of the ability to open the mouth¹³; the measurement of thyromental distance¹⁴; the performance of the Mallampati test¹⁵; and testing of neck-atlanto-occipital flexure and extension.¹⁶ A combination of a Mallampati test result \geq III and thyromental distance \leq 7 cm are used as criteria in predicting difficult intubation, with high sensitivity and specificity.¹⁴ In Chinese women, a combination of Mallampati test result \geq III and thyromental distance \leq 5.5 cm is regarded as a more appropriate criterion.¹⁷

Dental assessment includes a careful examination and proper documentation of the dental state of the patient, including loose teeth, dentures, false teeth, and removable bridges.¹⁸ Patients at risk of dental damage should be informed, with a preoperative dental check-up performed whenever possible.

Preoperative laboratory tests

Value of preoperative laboratory tests

The practice of a routine preoperative 'battery' of laboratory screening tests in apparently healthy individuals is of minimal or no benefit.⁶ Laboratory tests should be ordered when evidence in the history or physical examination suggests that an abnormality may exist.

No controlled trials of the value of routine preoperative tests have been published.¹⁹ A wide range of abnormal results is observed, even in apparently healthy individuals. A normal range is derived from results based on the typical Gaussian

distribution. Five percent of 'normal' individuals may be expected to have a test result outside the normal range.⁶

Findings from routine preoperative chest X-rays are reported as abnormal in 2.5% to 37.0% of cases, while abnormal routine preoperative electrocardiograms (ECGs) are found in 4.6% to 31.7% of cases.¹⁹ Electrocardiographic abnormalities are common, and their occurrence increases exponentially with age.⁶ Electrocardiographic screening of patients without cardiovascular risk factors is of low predictive power for perioperative cardiac complications in non-cardiopulmonary surgery.^{19,20}

A haemoglobin level lower than 100-105 g/L is observed in up to 5% of patients, but levels below 90 g/L are rare. Platelet and white cell counts are low in 1% of asymptomatic patients.

The yield of the tests in terms of identification of unsuspected disease is very low. Abnormalities detected rarely lead to a change in the clinical management of asymptomatic patients.²¹ In addition to the unwarranted expense, laboratory screening tests in asymptomatic patients may initiate follow-up activities that may be harmful to the patient.⁶

Routine tests for high-risk patients

Both abnormality yield and impact on patient management rise with age. For elderly patients and patients undergoing moderately to highly invasive procedures,⁶ the tests are useful as a baseline if the patient develops unexpected complications in the perioperative period. The decision to proceed or not in the presence of abnormal laboratory findings depends on the severity of the abnormality, the urgency of the procedure versus the chance of improvement in reasonable preoperative time, and the likelihood of influencing the outcome of anaesthesia if uncorrected. The increased risk of anaesthesia with abnormal laboratory findings should be discussed with the surgeon and the patient.

Specific tests for cardiac or respiratory assessment or other medical conditions are too large a subject to discuss in detail. Recommendations exist on the indications for routine preoperative investigation in local public hospitals.²²

Preoperative fast

The purpose of the preoperative fast

The purpose of the preoperative fast is to allow sufficient time for gastric emptying of ingested food and liquid, to prevent aspiration of gastric contents into the lungs. Aspirated acidic gastric contents may cause fatal aspiration pneumonitis, depending on the volume and the acidity of the aspirate. The concept of a critical pH and volume of aspirate was introduced by Roberts and Shirley²³ from data derived from rhesus monkeys. The critical pH of 2.5 and critical volume of 0.4 mL/kg body weight cited have since been challenged. The overall risk of aspiration for all

patients appears to be small,²⁴ with low morbidity and very little mortality.²⁵

Prevention of pulmonary acid aspiration

The risk of acid aspiration is much increased with a short fasting time or full stomach resulting from delayed gastric emptying in pre-existing conditions such as pregnancy, obesity, diabetes mellitus, or acute trauma. Gastric emptying can be greatly prolonged by anxiety, stress, and pain.

Prevention of pulmonary aspiration is an important aspect of safe anaesthetic practice, including preoperative identification of risk, the preparation process, and the skilful conduct of anaesthesia.

There is no agreed 'safe' fasting time for emergency or obstetric patients. It is common practice to advocate 6 hours' fast, as for elective operations, unless the benefits of emergency operation outweigh the potential risk of aspiration.

In order to minimise the risk and reduce the damage of acid aspiration, it is important to identify predisposing factors including increased gastric pressure, increased tendency to regurgitate, and laryngeal incompetence,²⁵ and to take full-stomach precautions for patients at high risk of aspiration. These may include chemoprophylaxis, preoperative emptying of the stomach, avoidance of general anaesthesia if applicable, and use of cricoid pressure and rapid sequence induction if general anaesthesia is indicated. Sodium citrate has long been used safely for obstetric cases. H₂-antagonists such as ranitidine may be given 1 to 2 hours preoperatively.²⁶

Current practice

Traditionally, 'nil by mouth after midnight' in all patient groups enforces a fast of more than 8 hours before elective surgery.

Recent studies have found that ingestion of clear fluid up to 2 hours before surgery does not increase gastric volume,²⁷ and may even decrease gastric volume by promoting gastric emptying.²⁸ The concept of an 'empty' stomach is challenged. The stomach is never completely empty, even after a midnight fast, since it continues to secrete gastric juice, giving rise to a significant residual gastric volume. Prolonged fasting results in increased gastric pH²⁵ and thus decreases the severity of pneumonitis should aspiration occur.

Most solid food exits the stomach within 4 hours. A light meal including toast may be taken 6 hours before elective procedures, while the wait after a meal including fried or fatty foods or meat should be 8 hours or more.²⁹

For both adults and children, it is recommended that no solids be allowed for 6 hours before anaesthesia, and no clear liquids for 2 hours before anaesthesia (Box).²⁹⁻³²

Preoperative fasting regimen for all healthy patients undergoing elective surgery (including children older than 3 years)

- (1) No solid food (including milk) for 6 hours before anaesthesia. Restriction of solid food after midnight in adults and children older than 3 years is an acceptable and commonly employed regimen³¹
- (2) No fluid for 2 hours before anaesthesia except for oral medication
- (3) Clear fluid is allowed 2 hours before anaesthesia. In order to ensure that younger children have access to oral fluid, it is advisable to instruct the nurse or parent to offer a clear fluid drink up to 10 mL/kg (to a maximum of 100 mL), 3 to 4 hours before anaesthesia³²
- (4) Solid food must be light (toast, rice porridge³³) on the day of surgery. A fasting period of ≥ 8 hours is recommended for a meal of fried or fatty foods²⁹

Relaxation of fluid restriction has led to greater cooperation and improved patient comfort.³³

Duration of fast in children

New guidelines for young children are emerging, because these patients are less able than adults to tolerate a prolonged fast. Young children have a higher metabolic rate, and a larger ratio of body surface area to weight than adults, and become dehydrated more easily. Starvation is thought to be the easiest way to ensure an empty stomach, but this leads to hunger, thirst, and an unpleasant experience for the children.

It is recommended that no solid food be allowed after midnight in children older than 3 years,³⁰ but clear fluid is allowed until 2 hours before anaesthesia for elective procedures.³¹ The risk of aspiration should be carefully balanced against the risk of dehydration and hypoglycaemia.

Premedications

Not every patient needs premedication. The goals of anaesthetic premedication are to provide anxiolysis, amnesia, analgesia, anti-emesis, pulmonary aspiration chemoprophylaxis, and thromboembolic prophylaxis. Other premedications include antibiotic prophylaxis for cardiac lesions/valvular replacements, bronchodilators, and antisialogogues.

Each drug has its own problems, including cost, side-effects, potential hypersensitivity reactions, prolonged sedation, or drug interactions.³⁴ As modern anaesthetic drugs and analgesics become faster in onset, shorter-acting, and more potent, premedication is becoming less important, especially in the day-case setting.

Anxiolysis and amnesia

Anxiety is a subjective feeling,³⁵ and it is difficult to determine whether a patient is anxious or not simply by considering the site or extent of surgery.³⁶ It is well known that adequate anxiolytic premedication will mitigate the normal stress response to surgery and anaesthesia.^{35,37} Most surgical patients under local anaesthesia favour anxiolysis by sedation.³⁸ Together with reassurance, short-acting benzodiazepines are commonly used for this purpose.³⁹ They

produce amnesia, which is appropriate for particularly traumatic procedures, and can also reduce the incidence of awareness under general anaesthesia.³⁸

Analgesia

Analgesia is desirable if the patient has pain preoperatively, eg fractures. The practice of pre-emptive analgesia, to reduce intra-operative requirements for anaesthetic agents and analgesics,⁴⁰ has shown to be effective in some studies⁴¹ but not in others.⁴² Opioids may give rise to sedation, respiratory depression, nausea, and vomiting. Non-steroidal anti-inflammatory drugs are commonly used because they give rise to less sedation and euphoria.⁴³

Anti-emesis

Anti-emesis is useful for patients with previous vomiting following surgery.⁴⁴ It is also recommended for middle ear, eye, and gynaecological operations, when postoperative nausea and vomiting are more likely,⁴⁵ and is also advisable if an opioid is given as premedication. Metoclopramide, droperidol, and ondansetron are the most common drugs of choice.⁴⁶ Dexamethasone has also been found to be effective for anti-emesis.⁴⁷ Multimodal anti-emetic management is necessary for patients with high risk of postoperative nausea and vomiting.⁴⁵

Thromboembolic prophylaxis

Thromboembolic prophylaxis should be employed in patients at high risk of deep vein thrombosis. Low-dose heparin or low molecular weight heparin are most commonly used.⁴⁸

Other premedicants

Antivagal premedication is sometimes required in operations that give rise to severe vagal stimulation leading to bradycardia or asystole, for example in ophthalmic surgery. Antisialagogue agents are very helpful for premedication in infants, especially when intra-oral surgery is to be undertaken, or when fiberoptic intubation is planned. Intramuscular atropine is still the most common preparation for these purposes.

In patients with narrowed or irritable airways, eg those with chronic obstructive airway disease or asthma, the use of inhaled β_2 -agonists or anticholinergics may be helpful.

Continuation of regular medications

It is not uncommon for surgical patients to be taking several regular medications for their medical conditions. In order to maintain the patient's intra-operative physiology within the desirable range, most essential medications are continued on the day of surgery, administered with sips of water only.

While it would be impossible to list all drugs that should be continued or discontinued preoperatively, the more common of these are discussed. Continuation of most anti-hypertensives,⁴⁹ cardiac drugs, bronchodilators,

anti-epileptic drugs, and antipsychotics is recommended, so as to maintain normal haemodynamic and respiratory status.

Many drugs have side-effects that might make anaesthesia more risky or patient management more difficult. Discontinuation of monoamine oxidase inhibitors,⁴⁹ diuretics, anticoagulants (where surgical haemostasis is required), oral hypoglycaemics, angiotensin-converting enzyme inhibitors,⁵⁰ and angiotensin II antagonists⁵¹ is recommended. Drugs should be discontinued for at least three and preferably five half-lives.

Cerebrovascular accident

Low-dose aspirin (<650 mg/day) should be continued in patients with a history of cerebrovascular accident, even when neuro-axial anaesthesia is planned,^{52,53} in order to reduce the risk of cerebral reinfarction. Platelet count and function appear not to be greatly affected.⁵³

Diabetes mellitus

For diabetic patients on oral hypoglycaemics, the usual practice is to schedule the patient as the first case in the morning, discontinue oral hypoglycaemics on the morning of the operation, and commence insulin/dextrose/potassium infusion for the duration of fasting if necessary. Blood glucose monitoring is of paramount importance in these patients. In insulin-treated patients, the morning dose of insulin is omitted.

Adrenal suppression

In patients on long-term steroids, the adrenal glands remain suppressed for at least 3 to 6 months even after steroid therapy is discontinued. Thus, hydrocortisone premedication is essential to help patients to cope with surgical and anaesthetic stress.

Anticoagulant management

In patients on oral anticoagulant therapy to reduce the risk of stroke from atrial fibrillation and other cardiac disorders, warfarin may be discontinued for several days before the operation to avoid perioperative bleeding. In patients with mechanical cardiac valve prostheses, and those with a history of acute venous thromboembolism within the previous 4 weeks, anticoagulants such as warfarin should be switched for shorter-acting preparations such as unfractionated heparin infusion at least 3 days preoperatively, with careful monitoring of the clotting profile. Heparin infusion may then be stopped a few hours preoperatively to prevent intra-operative haemorrhage.⁵⁴

Consent and risk

Adverse anaesthetic outcome

Adverse anaesthetic outcome is defined as “the occurrence of unanticipated complication or death during or following anaesthesia that may be attributable to an anaesthetic”.⁵⁵ Anaesthesia-related mortality is an easily definable end-point,

but a rare event—in the order of one death per 63 000 procedures.⁵⁶

Minor adverse anaesthetic outcomes like nausea and vomiting, sore throat, and headache have been observed to occur with wide variation in rate between institutions, while major adverse outcomes occur more homogeneously, but are rare.⁵⁷

Predictors of adverse outcomes

Age and American Society of Anesthesiologists score

Anaesthetic risk increases with age and poorer American Society of Anesthesiologists score.⁵⁸

Medical predictors

Medical predictors are highly sensitive. The presence of congestive heart failure represents the highest risk of adverse outcome.⁶ Diabetes mellitus, angina pectoris of Canadian Cardiovascular Class III or IV, and myocardial infarction within 6 months before surgery are associated with adverse cardiac outcomes including death.⁵⁹

Hypertension has been shown to predict the occurrence of intra-operative cardiovascular events, obesity to predict intra-operative and postoperative respiratory events, and gastroesophageal reflux to predict intubation-related events.⁶⁰

In 1996, anaesthesia-related clinical guidelines for perioperative cardiovascular evaluation in non-cardiac surgery were proposed, focusing on clinical predictors of risk.⁶¹ Clinical predictors of increased perioperative cardiovascular risk were stratified as major (unstable coronary syndromes such as recent infarction and unstable angina, decompensated congestive heart failure, significant arrhythmias, severe valvular disease), intermediate (mild angina, old Q-wave myocardial infarction, compensated congestive heart failure, diabetes mellitus), and minor (advanced age, abnormal ECG with ST-T changes, rhythm other than sinus, history of stroke, uncontrolled systemic hypertension).⁶¹

Surgical predictors

Mortality is related to the degree of impairment of general health by the disease necessitating surgery.⁶ Major surgery usually represents a tremendous assault on the body. The task of the anaesthesiologist is to maintain homeostasis during the procedure, and to provide pain relief to blunt the effects of the assault. Cardiac risk is reported to be high (>5%) in urgent major operations, especially in elderly patients.⁶¹

Risk disclosure

The conclusion of preoperative preparation includes a discussion of the risks of the anaesthetic intervention appropriate for the proposed surgical procedure. The extent of disclosure is highly variable, but should include at least the commonly occurring minor adverse anaesthetic

outcomes, and rare but possible major adverse outcomes, if applicable. The discussion should be guided by the patient's wishes and degree of understanding.

Risk reduction strategies employed preoperatively include encouragement of cessation of smoking, education of the patient about lung expansion manoeuvres, stabilisation of cardiac status, control of blood pressure, control of blood glucose, and an adequate pain relief strategy.

Consent

Some local hospitals have commenced the practice of obtaining a separate written consent for anaesthetic procedures, along with an explanation to the patient by the anaesthesiologist. The risks of anaesthesia are closely related to the proposed surgical procedure, and are sometimes quite inseparable from operative risks, thus requiring the anaesthesiologist to draw on good communication skills in order to provide a clear explanation.

Education

Educational pamphlets about anaesthesia are prepared in local public hospitals. Besides explaining the anaesthetic plan, fasting instructions, and related risks, quality anaesthetic practice includes understanding patients' fears about anaesthesia. In one study, fear of brain damage, death, waking up intra-operatively, and memory loss associated with general anaesthesia were shown to be prevalent.⁶² The preoperative interview provides an opportunity to address patient concerns.

Conclusion

The ultimate goals of preoperative evaluation of the patient are to reduce the morbidity of surgery, to increase the quality but decrease the cost of perioperative care, and to return the patient to desirable functioning as quickly as possible. Areas of controversy still exist, such as the practice of pre-emptive analgesia, preoperative continuation or discontinuation of drugs such as aspirin, and perioperative management of venous thrombosis.

Preoperative medical optimisation has been shown to significantly reduce complications. A knowledgeable anaesthesiologist coordinating optimal perioperative management is the 'final clinical gatekeeper' for the patient entering the operation room.

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