Methodology for a study of structured co-management of high-risk postoperative patients in a teaching hospital

The Austin Health Post-Operative Surveillance Team (POST) Investigators

Modern hospitals treat patients with increasingly complex problems and comorbidities.[1] In the United States it is expected that there will be a 100% rise in postoperative complications over the next two decades.[2] Increasingly, studies of high-risk surgical patients suggest that risk factors for postoperative complications may be identified preoperatively.[3-7] It is also apparent that the vast majority of postoperative complications are medical in nature and related to a patient's medical comorbidity.[3-7]

Implementing an intensive care unit-based Medical Emergency Team (MET) at our hospital led to a reduction in postoperative complications in patients undergoing major surgery.[3,8,9] However, this approach is reactive and responds only when a patient has begun to deteriorate. A pre-emptive and proactive model of postoperative care may prevent such deterioration from occurring in the first place, and further improve outcomes. Consistent with this, studies at our institution have shown that anaesthesia outreach services improve the outcomes of surgical patients.[10,11]

The traditional model of postoperative care involves medical referral and consultation,[12,13] but this model may be associated with delays in review and variable

Abbreviations

APS	Acute Pain Service
ASA	American Society of Anesthesiologists
HMO	Hospital medical officer
ICNC	Intensive Care Nurse Consultant
ICU	Intensive care unit
LOS	Length of stay
MET	Medical Emergency Team
PARU	Post Anaesthesia Recovery Unit
POST	Post-Operative Surveillance Team

ABSTRACT

Background: Patients undergoing major surgery often suffer postoperative complications, and in many cases these are related to medical comorbidity.

Objectives: To develop a structured approach for referral, postoperative management and surgeon communication for high-risk surgical patients based on medical co-management using a Post-Operative Surveillance Team (POST).

Design, settings, participants: Pilot study involving (i) a literature review to identify risk factors for postoperative complications; (ii) assessment of Medical Emergency Team (MET) call rates on surgical wards; (iii) development of a potential target surgical cohort from hospital electronic databases; (iv) formulation of checklists for assessment and intervention; (v) formulation of guidelines for referral to the POST and communication with surgeons; and (vi) guidelines for interactions with other postoperative surveillance services. The pilot study was conducted in two surgical wards of an academic teaching hospital between 1 March and 30 June 2010.

Main outcome measure: Successful development of a feasible, reproducible and testable model for medical co-management of postoperative care.

Results: Increasing age, unplanned surgical admission, low preoperative albumin level, and increasing American Society of Anesthesiologists (ASA) score were identified as preoperative risk factors for postoperative complications. Funding was obtained for two senior registrars, two intensive care nurses and a project officer. Surgeons were consulted and included at all phases of study development. Two surgical wards receiving 28% of all MET calls in the preceding 15 months were targeted for the pilot. Analysis of the hospital electronic database for 4 months of admissions in five target surgical groups admitted to the target wards during 2009 identified a cohort of patients based on eligibility criteria of (i) unplanned admission in patients aged $\geqslant$ 55 years; or (ii) planned admission in patients aged $\geqslant$ 80 years; and/or (iii) admission to the intensive care unit. An extensive education program was conducted to facilitate referrals from the Post Anaesthetic Recovery Unit, surgeons, and ward nursing staff to the POST. Checklists for assessment and intervention were developed based on five domains: (i) analgesia; (ii) surgical site management; (iii) resuscitation of deranged physiology; (iv) rehabilitation; and (v) management of medical comorbidities in the postoperative period. Based on expected caseload, a 5-day postoperative review period was recommended by the management committee. After this period, patients with ongoing problems were to be referred to a medical unit.

Conclusions: We successfully developed a feasible, reproducible and testable model to study the effects of a POST in selected wards at our hospital. The acceptance of this model by surgical ward staff and surgeons, as well as its effect on patient outcomes, remain to be determined.

Crit Care Resusc 2010; 12: 277–286

enactment of suggested care.[12,13] In the US, there is increasing use of hospitalists to co-manage patients to ensure that postoperative treatments are implemented in a tailored manner.[12,13] However, potential problems associated with this model include its unnecessary application to low-risk patients (leading to cost-inefficiency and overworked hospitalists), practice variation, imprecise definitions of the model of co-management, and the potential for confusion and medical error due to conflicting orders.[12,13]

The purpose of our project was to develop a testable, feasible, reproducible and structured model for postoperative co-management of high-risk surgical patients in a teaching hospital. The major aims of the project were (i) to ensure surgical involvement at all phases of the process; (ii) to establish inclusion criteria for referral, to balance patient risk and team caseload; (iii) to establish clear methods of referral and communication between staff; and (iv) to develop a structured approach to assessment and intervention based on five predefined care domains. We report here on the process of developing this model and the final details of the model.

Methods

Project organisation and administration

A grant application was submitted to the Victorian Department of Health by members of the hospital executive and the director of the Surgical Clinical Services Unit.

A steering committee convened monthly to oversee the project, and contained representatives from the areas of surgery, anaesthesia, intensive care, internal medicine, ward nursing staff and allied health, as well as the Victorian Department of Health. A management committee oversaw the day-to-day running of the project, including ethics submission, Post-Operative Surveillance Team (POST) personnel appointments, location of the office and connection with ward teams, as well as development of the project design, assessment and intervention tools, and data collection mechanisms (see Appendix for personnel).

Literature review for developing inclusion criteria

We performed a literature review to (i) summarise current knowledge about perioperative variables that predict postoperative complications; (ii) benchmark a representative hospital length of stay (LOS) for high-risk patients; and (iii) define the nature and incidence of postoperative complications.

Review of Medical Emergency Team calls

The hospital MET call database was interrogated to identify surgical wards in which MET reviews were most prevalent.

Power calculations

Hospital LOS was chosen as the primary outcome measure to assess the efficacy of the proposed system. Further, we proposed to conduct a before-and-after comparison with a suitable control group of patients. Power calculations were conducted to include median LOS for the cohort before the POST intervention (based on previously published literature), a 1-day reduction in LOS compared with baseline, and a length of follow-up finally agreed upon from the model developed.

Analysis of hospital database

We reviewed the hospital electronic database to assess admissions to surgical wards for the period 1 March 2009 to 30 June 2009. A variety of patient cohorts were constructed using variables predictive of increased postoperative risk (age, sex, admission to the ICU, and unplanned admission to hospital).

Identification of target wards and specialties for implementing pilot project

The target wards were identified on the basis of MET call frequency, the casemix and parent unit of the patients admitted to the ward (particularly in relation to the findings of the hospital database analysis), and the presence or absence of other interventions that were already in existence for perioperative management of surgical patients for the given surgical unit.

Development of model for assessment and intervention

The model and associated checklists were developed after repeated reviews by members of the management and steering committee. The five major care domains of the checklists were (i) analgesia; (ii) surgical site management; (iii) resuscitation of deranged physiology; (iv) rehabilitation; and (v) management of medical comorbidities in the postoperative period.

Referral mechanism

We proposed to develop a poster, to be displayed in the Post Anaesthesia Recovery Unit (PARU) and participating wards, to assist with POST referral. Additional ward-based mechanisms to ensure capture of all patients were proposed and developed.

Details of pre-existing critical care surgical outreach services

The MET was introduced in October 2000.[3] It is led by an ICU registrar and ICU nurse, and is activated when a patient develops deranged vital signs that fulfil predefined criteria that are displayed on posters in the hospital wards. There is an additional criterion ("ward staff are worried about the patient") to allow staff to obtain help for any other reason.

The Intensive Care Nurse Consultant (ICNC) service was introduced in July 2006. ICNCs primarily review patients discharged from the ICU, but also review patients following MET review. A smaller number of reviews come from ward

nurses for patients who do not fall into either of these categories.

A consultant-led Acute Pain Service (APS) also reviews a subset of surgical patients in hospital wards, and provides additional opportunity for identifying and treating deteriorating patients.[10,11]

Guidelines for interaction with other services

Guidelines were developed for interaction of the POST with the MET, APS, ICNC, and physiotherapy services. In addition, the conditions and methods to communicate with the parent surgical units and individual surgeons were established. Finally, guidelines for ongoing referral to a general medical unit were established for instances in which the patient had ongoing medical issues after the period of routine POST review.

Ethics approval

Approval was obtained from the hospital Human Research Ethics Committee to conduct the project and to collect and report on the project data.

Results

Funding and scope of pilot project

Funding obtained from the federal government's Elective Surgery Waiting List Reduction Plan via the Victorian Department of Health ($200 000), as well as the Austin Health Department of Intensive Care ($20 000), permitted a pilot project that covered non-salary overheads and employed a project officer part-time for 11 months. In addition, two senior doctors and ICU nurses (about $55 000

Table 1. Summary of studies identifying risk factors for surgical morbidity and mortality

Study	Patient cohort	Measures of risk
Bellomo et al (2002)[3]	• 1125 patients • > 48 h admission to hospital • Mean age 61.3 years • Median age 65.5 years • 37.9% unscheduled surgery • 17.8% went to ICU after surgery	• 16.9% had SAE and 7.1% died • Hospital LOS 18.4 days (without SAE) v 38.5 days (with SAE) • Mortality 20% in patients aged > 75 years with unscheduled surgery • Mortality 14% in patients aged > 75 years with no planned ICU support • Incidence of SAEs not related to surgical unit or sex of patient
Jones et al (2007)[4]	• 2429 patients • > 48 h admission • Assessed predictors of long-term (1500-day) mortality for cohorts before and after introduction of MET	• 1500-day mortality 34.2% (control period) v 28.4% (MET period) • Predictors of increased 1500-day mortality: ➢ Thoracic surgery and neurosurgery ➢ Oncology patients needing surgery ➢ Increasing age
McNicol et al (2007)[5]	• 1102 patients • Age > 70 years • Three Melbourne hospitals • Non-cardiac surgery • Expected to stay > 1 night • Median age 77 years • 70% of patients had ASA score 3–5	• Thoracic surgical patients had highest postoperative mortality • Overall: ➢ 19% had complications within 5 days ➢ 6% mortality • Median LOS 7 days (without complications) v 13 days (with complications) • Preoperative predictors of mortality: age, ASA score, albumin level < 30 g/L, admission under thoracic surgery • Postoperative predictors of mortality: unplanned ICU admission, acute renal impairment
Story et al (2009)[6]	• Calculation of perioperative mortality risk score • Cohort as for McNicol et al[5]	• Preoperative predictors of mortality: age, ASA score, albumin level < 30 g/L • Postoperative predictors of mortality: ICU admission, inflammation, acute renal impairment
Calzavacca et al (2010)[7]	• 1664 patients • 2237 MET calls • Austin Hospital	• 1290 patients (77.5%) had single MET calls and 374 (22.5%) had multiple MET calls • Compared with patients with single MET calls, those with multiple MET reviews were more likely to have the following characteristics/outcomes: ➢ Surgical patients ➢ Admitted for gastrointestinal tract disease ➢ 50% longer hospital LOS ➢ Higher rate of unplanned ICU admissions (13.3% v 25.7%) ➢ 34.6% increased mortality

ASA = American Society of Anesthesiologists. ICU = intensive care unit. LOS = length of stay. MET = Medical Emergency Team. SAE = serious adverse event.

each) staffed the service between 08:00 and 17:00, 7 days a week for 4 months.

The pilot was geographically confined to two wards to facilitate education, induction, communication and patient enrolment, and to ensure the caseload was not excessive.

Findings of literature review

From five recent publications relating to high-risk surgical patients,[3-7] a number of risk factors were identified: increasing age, unplanned hospital surgical admission, low preoperative albumin level, increasing ASA (American Society of Anesthesiologists) score, admission under thoracic or neurosurgical unit, development of acute renal impairment, and requirement for MET review or unplanned ICU admission (Table 1). A representative median hospital LOS was determined to be 8 days.

Findings of Medical Emergency Team reviews

Between July 2008 and October 2009, 2108 MET calls were registered in the MET call database. During this period, three surgical wards received 36% of all MET calls in the hospital (Table 2), with two wards receiving 28% of all calls.

Selection of wards for pilot project

The two pilot wards were the surgical wards with the highest number of MET reviews and the absence of a pre-existing mechanism for physician review (other than the gastroenterologist for liver transplant patients) (Table 2).

Analysis of hospital electronic database

Using the risk factors of age, unplanned (non-scheduled) hospital admission, and admission to the ICU, we reviewed the hospital database to obtain a group of patients with an LOS of between 7 and 13 days who were admitted to the study wards. The combined cohort of patients aged ⩾55 years with unplanned admissions and/or admission to the ICU identified 276 patients over the 4-month period (median age, 68.0 years; median LOS, 10 days). The addition of patients aged ⩾80 years who underwent scheduled surgery identified a further 57 patients (median age, 83.0 years; median LOS, 3 days), which increased patient numbers sufficiently to power a case–control study (Table 3). Ten patients were in both groups (ie, admitted to the ICU and ⩾80 years of age). Thus the overall cohort developed contained 323 patients (median age, 72.0 years; median LOS, 8 days).

Table 2. Details of patient cohort and postoperative interventions prior to POST pilot study

Ward	Patient population	Existing service	Number of MET calls* (% of total calls)†
8E	Urology, colorectal, upper GIT	ICNC	308 (14.6%)
8W	Upper GIT, liver transplant, breast, hepatobiliary	ICNC, liver transplant physicians	272 (12.9%)
8N	Orthopaedics	ICNC, orthogeriatric unit	162 (7.7%)

GIT = gastrointestinal tract. ICNC = intensive care nurse consultant. MET = Medical Emergency Team. POST = Post-Operative Surveillance Team.
* Total number of calls for each ward over the period July 2008 to October 2009. † During this period there were 2108 calls in the MET database.

Table 3. Analysis of various cohorts from two target wards (8E and 8W) to identify a patient group suitable for POST intervention

Group	Total number	Mean age (yrs)	Median age (yrs)	Unplanned admission	Mean LOS (days)	Median LOS (days)	Male	Admitted to ICU
All patients admitted	831	59.0	61.0	45.2%	8.2	4.0	60.5%	13.2%
Unplanned admission	376	55.8	57.0	100%	10.9	7.0	57.2%	14.9%
Planned admission and admitted to ICU	54	65.8	66.5	0	18.6	10.0	57.4%	100.0%
Unplanned admission ⩾55 years and/or admitted to ICU, all patients admitted to ward	276*	68.9	68.0	80.4%	14.8	10.0	56.0%	40.0%
Elective admission ⩾80 years, all patients admitted to ward	57*	84.2	83.0	0	5.2	3.0	59.6%	15.8%
Elective admission ⩾80 years, unplanned admission ⩾55 years and/or admitted to ICU, all patients admitted to ward	323	71.2	72.0	68.4%	13.1	8.0	56.7%	34.1%
As above, but restricted to five study surgical units	220	71.6	73.0	62.3%	12.2	8.0	59.5%	38.6%

ICU = intensive care unit. LOS = length of stay. POST = Post-Operative Surveillance Team. * Ten patients were in both groups (ie, admitted to the ICU and ⩾80 years of age).

Figure 1. Referral form for POST service

POST Referral Form

(**P**ost **O**perative **S**urveillance **T**eam Project)

Surgical Services CSU Project

Patient Inclusion Criteria		
Must Include BOTH	Surgical Parent Unit	☐SU1 or ☐SU2 or ☐SU3 or ☐SU4 or ☐Urology
	Discharge Destination to	☐8 West or ☐8 East or ☐ICU – unplanned
AND – one of the following criteria		
☐	≥ 80 yo & elective surgery (on elective waiting list)	
☐	≥ 55 & unplanned surgery (not on elective waiting list)	
☐	Planned or unplanned admission to RHD	
☐	Discharge from ICU to the ward	
☐	Co-morbidity status could influence postoperative recovery Surgical team or ward staff member (minimum approval by ANUM) worried about the patient	

PARU Admission Details		
Referred By? (can tick more than 1)	☐Surgeon ☐Anaesthetist ☐PARU ☐Other	**Patient UR, DOB or Sticker:**
ASA	☐1 ☐2 ☐3 ☐4 ☐5 ☐E	
Surgical Procedure Description		
PARU Admission Date and Time	___ / ___ / **2010** _____ **hrs**	
PARU Stay	☐Standard Stay ☐Extended Stay ☐RHD	
Any issues during PARU stay		
PARU Discharge Date and Time	___ / ___ / **2010** _____ **hrs**	

POST – 7 days a week – 8am to 4pm – Contact ☎ 0402 930 716 Pager: 4824

ANUM = associate nurse unit manager. ASA = American Society of Anaesthesiologists. CSU = clinical service unit. E = unscheduled. ICU = intensive care unit. PARU = Post Anaesthesia Recovery Unit. RHD = recovery high dependency. SU = surgical unit.

Development of inclusion criteria

Patients were deemed to be suitable for POST review if they were admitted to the study wards, admitted to one of the five target surgical units, and had one of the following features: (i) admitted to the ICU; or (ii) age ⩾ 55 years and unscheduled surgery; or (iii) age ⩾ 80 years and elective surgery. We also added criterion (iv) "ward staff are worried about the patient", to cover patients whom ward staff perceived to be at high risk (Figure 1). Calculations conducted at the conclusion of the pilot study revealed that this would produce a cohort of 220 patients (median age, 73.0 years; median LOS, 8 days).

Guidelines and mechanism for referral and communication

The major proposed mechanism of referral was from the PARU. The nurse in charge of the shift screened the operating list, completed a referral form, and placed this in a dedicated POST referral pigeonhole. Multiple education sessions with PARU staff were held to explain the scope and role of the service and the method of referral.

Additional information sessions were held with anaesthetists at their weekly meeting, as well as the ward associate nurse unit managers. Finally, three presentations were made to the surgical morbidity and mortality meeting to explain the service and the mechanism of referral.

Development of structured model for assessment and intervention

An A4 sheet was developed for the assessment (Table 4) and the intervention (Table 5). Various lengths of follow-up were considered. We calculated that if 12 visits per day were done for 4 months (120 days), then 1440 therapeutic encounters would occur in 4 months. To see the 323 patients identified in the same period from 2009 during scoping conducted at the time of planning for the pilot, the length of follow-up would be about 4.6 days. Accordingly, a length of follow-up of 5 days was recommended for the routine POST review. The POST registrar and nurse were to present to the two wards to receive handover from ward medical and nursing staff and conduct a ward round during the morning. In the afternoon, they were to review new referrals and follow up outstanding issues from the morning ward round.

Power calculations

A recent study of patients aged 70 years or over reported that the median LOS was 7 days for those without complications and 13 days for those with complications.[7] If the hospital LOS were assumed to be 8 days at baseline, then a sample size of 320 patients in both the control and intervention groups (a total of 640 patients) would provide an 81% statistical power of detecting a 1-day reduction in hospital LOS, from 8 to 7 days, assuming an SD of 5 days and using an α value of 0.05.

Presentation to and involvement of surgical unit staff

Participation of, and consultation with surgeons occurred in all phases of the development and design of the pilot

Table 4. Checklist for POST medical and nursing assessment

1. Introduction to patient and/or relatives
   a. Role in care — "work with surgical doctors in your management"
   b. Explanation of what going to do (look through charts, examine you and look through test results)
   c. Inspection = initial impression causes immediate concern
2. Obtain update from treating staff (nurse, doctor, physiotherapist, etc)
3. Assess charts
   a. Vital signs/weight
   b. Fluid balance
   c. Food chart
   d. Bowel chart
4. Assessment of patient
   a. History
      i. Nervous system: "how is your pain"?
      ii. Cardiovascular system: "have you had any chest pain or palpitations"?
      iii. Respiratory system: "how is your breathing?", "do you have any cough or sputum?"
      iv. Gastrointestinal system: "do you have any nausea or vomiting?", "are you eating anything?", "how are your bowels?"
   b. Examination
      i. Nervous system: able to move all limbs equally
         Functional Activity Score (FAS): A (no limitation), B (mild), C (severe)
         (relative to baseline = any restriction above any pre-existing condition the patient may have)
      ii. Operative site (to be conducted by surgical fellow)
         1. Wound colour, integrity, discharge
         2. Content and volume of drain tubes
      iii. Cardiovascular system: warmth of periphery, capillary return, peripheral oedema, volume of pulse, jugular venous pressure
      iv. Respiratory system: sputum cup, auscultation of chest and heart sounds
      v. Gastrointestinal system: distension, tenderness, bowel sounds
      vi. Renal: urine output — indwelling catheter in situ — urine colour, urine analysis
   c. Investigations
      i. Blood tests
      ii. Results of cultures
      iii. Radiology
      iv. Electrocardiogram
5. Devices (integrity, position, signs of infection, is the device still needed?)
   a. Nasogastric tube
   b. Central line/peripheral line
   c. Oxygen — appropriate for SpO_2 and presence of known CO_2 retention
6. Assessment of medication chart
   a. Allergies (reconcile that none of drugs cause allergies)
   b. Check doses are reasonable/appropriate
   c. Ensure that the following are prescribed
      i. Analgesic
      ii. Deep venous thrombosis prophylaxis
      iii. Antiemetic
   d. Check route/mode of administration
      i. Preference for oral
      ii. Change to intravenous if not absorbing

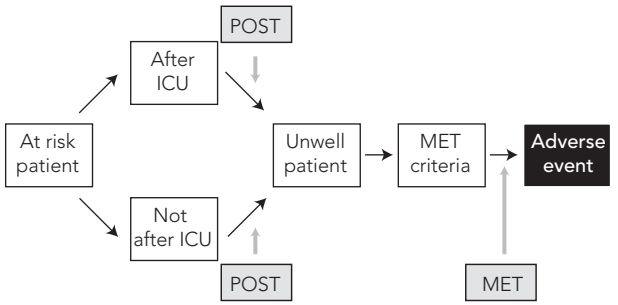
POST = Post-Operative Surveillance Team.

Table 5. POST recommendation/intervention checklist

1. Treatments
   - a. Analgesia (? is acute pain services referral needed)
   - b. Cardiovascular system management
     - i. Intravenous therapy fluids (amount, type and rate)
     - ii. ? Restart β-blocker (heart rate, blood pressure, cardiac output)
     - iii. ? Restart ACEi or angiotensin receptor blocker (check blood pressure, creatinine, urine output, on nonsteroidal anti-inflammatory drugs)
     - iv. Need for diuretic
   - c. Respiratory system management
     - i. Chest physiotherapy and ambulation
     - ii. Oxygen: amount, type and mode of delivery; ? humidification needed
     - iii. ? Is non-invasive ventilation needed for physiotherapy
     - iv. Nebulisers or metered dose inhalers for chronic lung disease
   - d. Haematological
     - i. Anticoagulation: deep venous thrombosis prophylaxis and antiplatelet therapy
     - ii. Transfusion/blood loss
   - e. Gastrointestinal management
     - i. Diet and feeding: ? dietitian referral needed
     - ii. Bowels: ? aperients needed
     - iii. ? Can medications be given orally
   - f. Infectious disease issues (? is infectious disease referral needed)
     - i. ? Changing of commencement of antibiotics based on cultures
     - ii. De-escalation or cessation of antibiotics
   - g. Ensure that all opinions from referrals have been implemented
   - h. ? Need for any of the following
     - i. Follow-up visit — by whom and when (surgical, POST, medical specialty)
     - ii. Referral
       1. Specialty medical/surgical service
       2. Allied health
     - iii. Investigations
       1. Blood tests
       2. Results of cultures
       3. Radiology
       4. Electrocardiogram/echocardiography
2. Documentation
   - a. Tick off abbreviated assessment and intervention checklist in Access database
   - b. Formulation of assessment and recommendations
   - c. Updating POST patient list
   - d. Print off POST report and place in patient's file
     - i. This patient was reviewed by POST
     - ii. These were the major issues identified
     - iii. This is the proposed management plan
     - iv. Time and date when discussed with surgical team member
3. Communication
   - a. Staff members on ward (registered nurse, associate nurse unit manager, allied health)
   - b. Completion of referral form if appropriate
   - c. Treating surgical fellow — phone call on mobile or page
   - d. Patient and/or relatives regarding issues and proposed treatment(s)

ACEi = angiotensin-converting enzyme inhibitor. POST = Post-Operative Surveillance Team.

Figure 2. Schematic diagram showing potential plight of an at-risk and deteriorating surgical patient and proposed stage of intervention of POST and MET



ICU = intensive care unit. MET = Medical Emergency Team.
POST = Post-Operative Surveillance Team.

project, including representation in the steering committee, presentations at the weekly surgical morbidity and mortality meeting, and face-to-face meetings with consultant surgeons in the operating room. We obtained input regarding the scope of practice of the POST staff and the conditions under which discussions and referrals should be made. The consultant surgeons emphasised the importance of regular communication about significant changes in patient status and advanced notice of significant changes in management.

Education of ward staff

Repeated education was undertaken with associate nurse unit managers and nurses on the two target wards. The two nurses employed in the POST role assisted with routine patient care during the week before the pilot started and attended all morning nursing handovers for the first 2 weeks.

Development of physiotherapy substudies

During engagement of physiotherapy services, separate physiotherapy substudies were developed. The aims of these studies were to prospectively document the details of physiotherapy intervention, the incidence of postoperative pulmonary complications, and a range of predefined barriers to physiotherapy treatment.

Surgical hospital medical officer supervision and education

During implementation of the POST pilot, senior surgeons raised the concern that the program would deskill surgical junior hospital medical officers (HMOs). To address these concerns, HMOs attended the POST ward round and participated in the process of assessment and referral. In addition, a questionnaire was developed to assess the HMOs' experience and attitudes toward the POST.

Guidelines for interaction with other services

Education of POST and ward staff emphasised that the major role of the POST was to prevent deterioration from occurring. Thus, the MET is reactive and responds when patients develop instability (MET criteria), whereas the POST is pre-emptive to prevent deterioration developing in the first place (Figure 2).

It was emphasised that the POST should not spend excess time reviewing patients fulfilling MET criteria, as this may delay transfer to the ICU. In addition, frequent interaction and consultation with the APS was encouraged.

During the pilot period, the ICNC service did not review patients who were reviewed by the POST. ICNC nurses remained on the ward to review patients who were not reviewed by the POST service.

Finally, members of the POST were instructed to refer patients to a general medical unit if they had unresolved medical problems after 5 days of routine POST review.

Major lessons learned

A number of important lessons were learned during the development of our structured model for postoperative co-management (Table 6).

Discussion

Summary of major achievements

We sought to develop a model for medical co-management of postoperative care, termed the Post-Operative Surveillance Team model. The model seems feasible with respect to patient caseload, and can be tailored for use in other hospitals. It will be testable by assessing ward staff acceptance of the model and by studying its effect on patient outcomes. Ensuring surgeon participation at all stages, we conducted a literature review, identified wards with high MET activation rates, scoped the hospital electronic database, formulated checklists for patient assessment and management, and developed guidelines for referral, communication and ongoing follow-up of POST patients. The pilot study successfully commenced in March 2010.

Comparison with previous studies

Most published studies reporting models of medical co-management of surgical patients involve orthogeriatric services for elderly patients with hip fractures.[14-18] One study reported a model of co-management following cardiac surgery in US veterans.[19] In our hospital, we have previously reported a model involving review of high-risk surgical patients by an APS.[10-11] In the US, Sharma and colleagues recently reported that 35.2% of patients hospitalised for common surgical procedures were co-managed by a medicine physician.[20] Despite this finding, we are unaware of

Table 6. Major lessons learned during the development of Austin Health POST model of care

1. Continuous involvement of surgical staff was needed to establish a mutually acceptable model of care, rules of engagement and pathways of communication
2. A literature review of postoperative surgical complications revealed that the majority of complications were medical in nature and not related to the original surgical procedure
3. Risk factors were identified that predicted increased postoperative risk, including:
    a. Increasing age
    b. Increasing ASA score
    c. Low preoperative serum albumin level
    d. Admission under thoracic, oncology or neurosurgical bed cards
4. Postoperative risk factors identified from the literature review included:
    a. Requirement for a MET call
    b. Requirement for unplanned ICU admission
    c. Development of acute renal impairment
5. Review of hospital MET database identified two surgical wards with high MET caseload
6. Scoping of hospital databases allowed investigators to develop inclusion criteria for POST review based on features identified from:
    a. Predefined risk factors
    b. Presence of pre-existing perioperative surgical support services
    c. Hospital length of stay
    d. Number of MET calls within potential target wards
7. Repeated education of Post Anaesthetic Recovery Unit, ward nursing staff and surgical staff was needed to establish clear pathways for:
    a. Referral to POST as early as possible in the first 5 ward days after surgery
    b. Communication of POST staff with surgical staff
8. Multidisciplinary input permitted development of a systematic model for patient assessment and treatment to ensure reproducibility of intervention between clinicians, based on five care domains:
    a. Resuscitation
    b. Surgical site management
    c. Pain management
    d. Rehabilitation
    e. Management of medical comorbidities in the perioperative period
9. Multidisciplinary input from surgical, internal medicine, anaesthesia, ICU, allied health and governmental representatives was required in the steering committee
10. Clear instructions are needed for staff to call or consult the correct support service (MET, POST, ICNC) for the immediate needs of the patient. Each of these services needs to be clearly branded

ASA = American Society of Anesthesiologists. ICNC = Intensive Care Nurse Consultant. ICU = intensive care unit. MET = Medical Emergency Team. POST = Post-Operative Surveillance Team.

any published structured model of review for patients undergoing major general surgical procedures.

Potential strengths and limitations of our model

The strengths of the model developed include (i) identification of at-risk patients based on a combination of preoperative risk factors (from contemporary literature); (ii) analysis of the hospital database to develop patient profiles for referral; and (iii) identification of hospital wards in which MET service use (and thus perceived need for critical care input) was greatest.

We also developed standardised assessment and intervention tools to minimise unwanted practice variation between members of the POST.

Our project had the major limitation that many components of the model were based on expert opinion of members of the management committee. However, we believe that the five domains chosen are intuitive and routine aspects of our postoperative care. The pilot study was developed and conducted in only one centre, and there is no guarantee that it could be successfully developed or accepted at other hospitals. Because of a late change in the proposed patient inclusion criteria, the final cohort is likely to have less than 230 patients. Accordingly, it is likely that the study will have less power to detect a 1-day reduction in LOS. The effect of the intervention on outcomes of patients reviewed by the POST remains untested.

Implications for clinicians and policymakers

The approach developed here provides an intervention using a structured and reproducible methodology. This will allow comparative studies of the intervention with standard care. It will also permit prospective assessment of common problems occurring after major surgery, analysis of factors that may contribute to them, and development of interventions to prevent and/or treat them. If shown to be effective, the POST may improve outcomes of at-risk surgical patients and improve bed access by reducing hospital LOS.

Areas for future research

We plan to assess the effect of the intervention on the outcomes of reviewed patients in comparison with a historical cohort. In addition, we will survey ward staff to assess acceptance and perceived usefulness of the service. Finally, we will conduct physiotherapy substudies to assess the incidence and predictors of postoperative pulmonary complications, as well as the frequency and nature of barriers to physiotherapy intervention.

Conclusions

We have developed a feasible, reproducible, testable and systematically structured approach to referral, assessment and treatment of high-risk surgical patients in a teaching hospital. It has the support and participation of all stakeholders. The effects of this intervention on patient outcomes, and acceptance of the service by the staff involved, remain untested.

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Appendix. Detailed list of Austin Health POST project investigators

Grant submission

Dianne Kelleher, Mark Petty, Melodie Heland

Steering committee

Melodie Heland (Chair) (Surgical CSU Director); Chris Christophi (Head Division and Surgical CSU Medical Director); Mark Petty (Executive Director, Acute Operations); Rinaldo Bellomo (Director Intensive Care Research); Daryl Jones (Project Medical Lead, Intensive Care Consultant); David Story (Consultant Anaesthetist); Chris O'Callaghan (Director General Medicine); Andrew Shelton (Project Officer); Tammie McIntyre, Helen Young and Carmel Taylor (Intensive Care Nurse Consultants); Dianne Kelleher (Director, Health Service Planning & Performance); Fiona Hull (NUM Recovery); Kate Ireland (NUM Ward 8W); Arlene Gonzales (NUM Ward 8E); Rebecca Monger (NUM Ward 8N); Carmen Yui (Department of Health Senior Project Officer, Surgical Services Program); Chris Potter (Department of Health Project Manager, Surgical Services Program)

Management and writing committee

Melodie Heland, Daryl Jones, Andrew Shelton, David Story, Rinaldo Bellomo

POST staff

Will Ainslie, Jo Arcaro, Jason Kwong, Kate Tozer

Physiotherapy subcommittee

Kimberley Haines, Selina Parry, Sue Berney

CSU = clinical service unit. NUM = nurse unit manager.
POST = Post-Operative Surveillance Team.