Review Article

Integrating perioperative medicine with anaesthesia in India: Can the best be achieved? A review

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ABSTRACT

Integrating perioperative medicine with anaesthesia is the need of the hour. Evolution of a new superspeciality called perioperative anaesthesia can improve surgical outcomes by quality perioperative care and guarantee imminent escalation of influence and power for anaesthesiologists. All original peer-reviewed manuscripts pertaining to surgery-specific perioperative surgical home models involving preoperative, intraoperative and postoperative initiatives spanning the past 5 years have been reviewed using PubMed and Google Scholar. Whether the perioperative surgical home model is feasible or still a distant dream in the Indian perspective has been analysed.

Key words: Enhanced recovery after surgery, perioperative medicine, surgical home

INTRODUCTION

Perioperative medicine signifies medical care of the patient right from admission, spanning the entire preoperative, intraoperative and postoperative periods.[1] Worldwide, it is gaining acceptance that 'perioperative medicine' is the future of anaesthesiologists. RD Miller, whose writings are gospels in anaesthesia, while chairing the American Society of Anesthesiologists' 'task force on future (2025) paradigms of anaesthesia practice', stressed that we need to diversify our practice paradigms to ensure a future leadership position in medicine.[2] The future is bright for anaesthesiologists who include perioperative medicine in their domain. Perioperative medicine can impart a new lease of life and relevance to our speciality which is largely retreating into the operation theatres (OTs): always behind the mask!

In this moment of truth, we can remain content with being a procedure-oriented speciality (intubation, neuraxial block, arterial cannulation) restricted to intraoperative care, or we could jump the OT confines and widen our clinical practice and intellectual domain to include quality perioperative medicine rooted in scientific research.[3] Enhanced Recovery after Surgery (ERAS), Enhanced Perioperative Care (EPOC) programme and Perioperative Surgical Home (PSH) are some of the pragmatic quality improvement (QI) initiatives adopted in surgery. This article shall focus on the establishment and organisation of an EPOC programme.

METHODS

A literature search was performed in January 2019 in MEDLINE, PubMed, EMBASE and the Cochrane Central Register of Controlled Trials for original peer-reviewed manuscripts pertaining to surgery-specific PSH models involving preoperative, intraoperative and postoperative initiatives spanning the past 5 years. A comprehensive search using PubMed and Google Scholar and reference crawling of all the selected articles retrieved 88 potentially relevant studies using keywords 'perioperative surgical home' and 'enhanced recovery after surgery'. We narrowed our review down

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to 35 studies after reviewing the abstract and methods' section of each article. There exists a paucity of Indian studies on surgery-specific PSH models.

LATTICE OF VERTICAL AND HORIZONTAL PATHWAYS

Perioperative medicine is a network of vertical and horizontal pathways.[4] Vertical pathways are based on surgical branches, for example, ERAS pathway for colorectal surgery and PSH model initiated for orthopaedic surgery.[5] Here different sets of skills are required to run each constituent microsystem: nursing, nutritionists, physiotherapy, laboratory services, human resource, central sterilisation and supply department, information technology, social service and so on.

Horizontal pathways are based on symptoms or diseases cutting across patients from all surgical branches, for example, prehabilitation clinics (preoperative risk stratification, risk reduction and care optimisation clinic, obesity and weight loss clinic, perioperative optimisation for senior health clinic, pain clinic, postoperative nausea vomiting prophylaxis clinic, diabetes clinic, anaemia clinic, smoking-cessation clinic, nutrition-optimisation clinic), postoperative pain relief and so on.

PERIOPERATIVE MEDICINE: A FELT NEED!

Although a prerequisite for good postoperative results, skilful surgery is not the only deciding factor. Adverse events strike 30% of hospital admissions, nearly half of these being preventable.[6] Emergency surgery has a much higher mortality attributed than elective surgery. A prospective cohort study on 187 patients,[7] 82% with comorbidities, found a 14.4% in-hospital mortality. Multivariate logistic regression revealed that age increased the odds for mortality by 4%, while anaemia, chronic renal failure and sepsis increased the odds for mortality three, six and seven times, respectively. Emergency exploratory laparotomy was the procedure with the highest mortality (47.7%). Mortality rate after elective major abdominal surgeries stays between 3% and 7% in contrast. Complications were recorded in 52.4% of the patients. Infectious, pulmonary and cardiovascular events were the most frequent (36.4, 26.3 and 12.3%, respectively). Of 473,619 procedures considered in another study,[8] 14.2% of patients underwent an emergency procedure. The odds ratio (OR) for such patients experiencing all-cause morbidity, serious morbidity and mortality was 1.20, 1.26 and 1.39, respectively. Another study[9] found that Friday evening and weekend surgeries have higher morbidity and mortality compared with weekday surgeries. The adjusted odds for mortality were 44% and 82% higher for Friday and weekend procedures, respectively. Less senior and less experienced/trained staff was the explanation given. Tracking perioperative mortality for a basket of procedures revealed the mortality rates to be much higher for lower and middle-income countries.

Burden of comorbidities, emergent nature of surgery, weekend timing of surgery and the income bracket of the country influence the postoperative morbidity and mortality rate. The common string in these four factors is the lack of patient optimisation and inadequate perioperative care. The perioperative physician needs to fulfil this unmet need. In developed countries, it is the anaesthesiologist who is the perioperativist and his invovement leads to improvement in the surgical outcome. Developing nations, including India, are still undergoing this transition.

INTERLINKING OF THE PREOPERATIVE, INTRAOPERATIVE AND POSTOPERATIVE PERIODS

Among the preoperative patient factors, although age of patient and nature/severity of disease are non-modifiable, preoperative screening and comorbidity optimisation are attainable by EPOC.

Intraoperative factors include risk of surgery, surgeon's skills, mode of anaesthesia, anaesthesiologist's skills, medical equipment quality and maintenance, surgical safety checklist, timeout before operation and sign-out after operation.[1] EPOC can modify the last four factors.

Postoperative factors such as the discharge pathway (outpatient, day-care or inpatient surgery), postoperative surveillance for complications (availability and training of nursing staff, nurse–patient ratio, frequency of physician visits, point-of-care testing facility) and rescue ability after complications (parenteral antibiotics, blood bank, interventional radiology, intensive care beds, ventilators, dialysis unit, cath lab) are all EPOC-modifiable.

ANAESTHESIOLOGIST: THE NATURAL CHOICE!

By virtue of training, special skills and experience, anaesthesiologists are the most suitable perioperativists. Preoperative screening, evaluation,

preparation, intraoperative anaesthetic and medical management, and acute postoperative care all fall in their purview. Many anaesthesiologists have additional training in critical care and are also pivotal members of multidisciplinary pain management teams. If anaesthesiologists can manage the potentially crisis-prone intraoperative period, they can be trusted upon to manage the pre- and postoperative periods too with equal efficiency. At the hands of a competent anaesthesiologist, this will also ensure continuity of care.

While surgical branches, like minarets of a monument, are quasi-independent units whose decisions and conduct are not controlled by others, anaesthesia is like the common platform holding these minarets. It traditionally caters to all surgical branches, each anaesthetist rotating between different surgical branches: neurosurgery, obstetrics, gastrointestinal surgery and so on.

Of late, superspecialisation in anaesthesia is trending, but it is debatable whether every neurosurgery case should be conducted by a neuroanaesthesiologist or whether all oncosurgery requires services of oncoanaesthesiologists. An oncoanaesthesiologist is a superspecialist with a difference. His superspeciality, just like cancer, is not restricted to one organ system. Further super superspecialisation into a head and neck oncoanaesthetist or a gynaeco-oncoanaesthetist would be absurd because he is the link between different surgical branches, who ensures smooth running of several parallel OTs through space, equipment, personnel and other resource management. Conversely, he needs to further diversify and incorporate perioperative medicine too. This dictum is applicable for all general anaesthesiologists too. Management of postoperative, chronic cancer and labour pains, cardiopulmonary resuscitation, blood transfusion and ventilator therapy all constitute the anaesthesiologist's domain.

ESTABLISHMENT AND ORGANISATION OF AN IDEAL PERIOPERATIVE CARE PROGRAMME

Fragmented and variable perioperative care needs replacement with value-based, patient-centred care. Per-capita cost of healthcare is rising due to aging of population, personal income growth, spiralling prices in healthcare sector, administrative costs, defensive medicine, supplier-induced demand, technology-related changes in medical practice and changes in third-party payment including medical insurance policies. The ingredients/rudiments of a perioperative care programme pre-exist in most hospitals. They just need revamping, redesigning and reengineering to bridge strategy, operations, tactics and finance to create a pathway that embodies the'triple-aim' (Institute for Healthcare Improvement) of providing the individual patient a quality experience, best value for available resources (reduced cost) and improving overall population health.[10] The anaesthesiologist should play a proactive leadership role to materialise this. The five steps to this effect are as follows:

Pathway creation

A 'modified Delphi method' can be used to arrive at a consensus and create a protocol for diagnostic and treatment plans based on literature review, existing guidelines and discharge targets. Provision for point-of-care testing for early identification of modifiable high-risk patient conditions, standing perioperative medical instructions and pharmaceutical orders, preparation of flowsheets, nursing documentation, incorporation of external prescriptions, workflow analysis and workflow design, and staff and space management are important elements. A steering committee with representatives from all concerned specialities with an anaesthesiologist as the project leader should be formed. Electronic care coordination from the preoperative clinic through e-mails to the steering committee pertaining to baseline clinical condition of the patient, clinical updates, any abnormal laboratory investigation results or pending diagnostics, existing medication plan, history or predictors of difficult airway and special patient requests may prove fruitful.[11]

Review committees and approval

Surgical recovery team review committee, nursing clinical practice review committee, pharmacy and therapeutics committee, prehabilitation and patient optimisation review committee and the medical archives committee (paper forms and electronic medical records) should meet face to face and give the new pathway their green signal.

Personnel training

The anaesthesiologists, internal medicine physicians, surgeons including surgery residents, nutritionists, physiotherapists and nursing staff should undergo rigorous training pertaining to specific requirements

of the preoperative clinic and recovery room. Personnel should also be briefed on patient education, patient tracking and providing the patient with a care map so that the patient does not bear the burden of scheduling multiple appointments on his own which only adds to the stress of surgery. Wide distribution of educational material is required. Nurse practitioners should be trained enough to provide a 24 h/day, 7 days/week postoperative cover to maintain continuity of care under guidance of a perioperativist–anaesthesiologist.[12]

Launch date

Everyone starts the new EPOC pathway together on a predetermined date.

Audit and revision

Periodic data review is imperative for QI under a shoestring healthcare budget. Monthly individualised report cards must be issued to anaesthesiologists, surgeons and nursing staff.

The anaesthesiologist is at the hub centre of the spoked wheel of perioperative medicine [Figure 1]. The surgeon and internal medicine physician along with the nursing staff, nutritionists and physiotherapists assist him. Multidimensional communication oils this wheel, reducing inter-caregiver friction and discord between the caregivers and the patients. Reduced change in hands under the dynamic leadership of an anaesthesiologist shall lead to reduced loss of information and enhanced patient care.

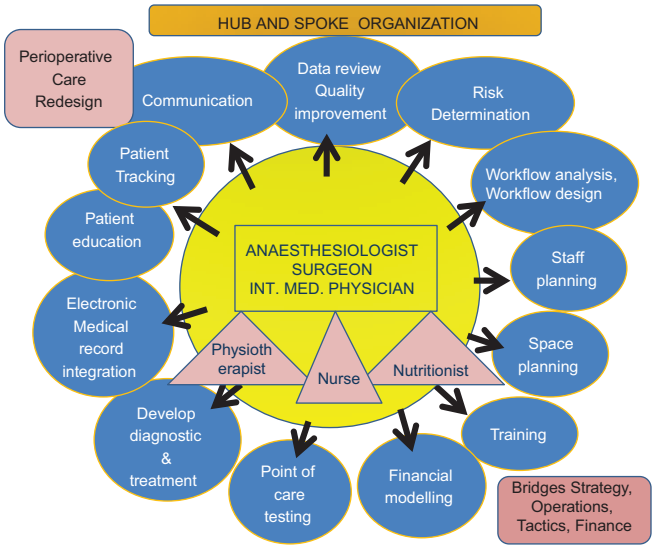

Figure 1: (Original): Organisation of enhanced perioperative care model with the anaesthetist at the hub centre

In many models, such as the 'Fast track model',[13] patients are under the surgeon's care after admission, under the anaesthesiologist's care intraoperatively and back under surgeon's care postoperatively. This is currently followed in India. The PSH model differs on three counts. First, the entire perioperative process, right from admission and one-stop surgery and anaesthesia preoperative visit for optimisation till PACU care and beyond for 30 days, involves active participation of the anaesthesiologists. Second, the anaesthesiologists exercise comprehensive perioperative medicine and third, anaesthesiologists assume a flagship position in clinical as well as material and human resource management.[14] In India, anaesthesiology is a surgeon-dependent branch. Rapport with surgeons and fellow anaesthesiologists demarcates the degree of stress, duty hours and the type and quality of work output for any anaesthesiologist who is responsible mainly for the intraoperative care of the patient.

ERAS PATHWAY

Elements of the ERAS pathways for different surgical subgroups are essentially the same with minor modifications.[15-49] General elements include preoperative nutritional screening, no preoperative bowel preparation, maltodextrin drink 2 h before surgery, prophylactic antibiotics, epidural or patient-controlled analgesia, prokinetic agents, goal-directed fluid therapy, early mobilisation, predefined criteria for removal of drains, nasogastric tubes and catheters, immediate extubation, early oral intake and a specific discharge plan. Surgery-specific elements like octreotide for pancreaticoduodenectomies, minimal tissue handling and minimally invasive surgery for urogynaecological oncosurgery or pharmacological thromboprophylaxis for head and neck free-flap surgery are important. Several original studies have evaluated the ERAS protocol initially for colorectal[15-17] followed by other surgeries. Advantages of adherence to ERAS are reduced length of hospital stay (LOS), reduced median operative time and intraoperative blood loss, reduced morbidity and complications, lower delayed gastric emptying rates, decreased insulin resistance, reduced IV fluid requirement during and for 3 days after surgery and improved 5-year survival [Table 1].[18-49] American Society for Enhanced Recovery and Perioperative Quality Initiative has recently (2018) issued joint consensus statements on optimal analgesia, prevention of postoperative infection, patient-reported outcome and postoperative gastrointestinal dysfunction within

Table 1: Review of randomised controlled trials spanning past 5 years pertaining to ERAS and PSH models

Surgery original study/year	Participants (*n*)	Outcome
ERAS (oesophageal cancer)		
Ford *et al*.[18] (2014)	75 (ERAS) 80 (Control)	↓Mortality (0 ERAS; 3 control) ↓Anastomotic leak (4 ERAS; 11 control)
Pan *et al*.[19] (2014)	40 (ERAS) 40 (Control)	↓LOS (from 12 to 8 d)
Al-Herz *et al*.[20] (2015)	30 (ERAS) 30 (Control)	↓LOS (from 15 to 13 d)
Shewale *et al*.[21] (2015)	386 (ERAS) 322 (Control)	↓LOS (12 to 8d); ↓Pul. complications (76 ERAS; 88 Control) ↓ leak anastomotic (45 ERAS; 49 control) ↓Mortality (9 ERAS; 11 control)
Wang *et al*.[22] (2015)	90 (ERAS) 90 (Control)	↓LOS (from 11.7 to 9 d) ↓Pul. complications (3 ERAS; 9 control)
Findlay *et al*.[23] (2015)	55 (ERAS) 77 (Control)	↓Mortality (1 in ERAS; 3 control) ↓Anastomotic leak (4 ERAS; 5 control)
ERAS (pancreatic surgery)		
Braga *et al*.[24] (2014)	115 (ERAS) 115 (Control)	↓LOS: 14.6 d ERAS, 16.1 d control; ↓delayed gastric emptying: 11 ERAS, 17 control; morbidity: 69 ERAS, 76 control; mortality: 4 ERAS, 4 control; readmission rate: 14 ERAS; 12 control; reoperation rate: 14 ERAS; 12 control
Pillai *et al*.[25] (2014)	20 (ERAS) 20 (Control)	↓LOS :15.75 d ERAS; 22 d control; delayed gastric emptying: 7 ERAS; 15 control; morbidity: 9 ERAS; 5 control Mortality: 2 ERAS; 1 control; readmission rate: 0 ERAS; 0 control; reoperation rate: 3 ERAS; 1 control
Coolsen *et al*.[26] (2014)	86 (ERAS) 97 (Control)	↓LOS: 13 d ERAS; 20 d control; gastric emptying time: 11 ERAS; 7 control; morbidity: 46 ERAS; 48 control Mortality: 4 ERAS; 6 control; readmission rate: 11 ERAS; 14 control; reoperation rate: 7 ERAS; 13 control
Nussbaum *et al*.[27] (2014)	100 (ERAS) 142 (Control)	↓LOS :11 d ERAS; 13 d control; delayed gastric emptying: 17 ERAS; 23 control; mortality: 1 ERAS; 4 control; readmission: 31 ERAS; 36 control; reoperation: 10 ERAS; 18 control
Sutcliffe *et al*.[28] (2015)	44 (ERAS) 37 (Control)	↓LOS: 7 d ERAS; 9 d control; delayed gastric emptying: 2 ERAS; 3 control; morbidity: 15 ERAS; 15 control; mortality: 2 ERAS; 0 control; readmission rate: 1 ERAS; 6 control
Morales Soriano *et al*.[29] (2015)	50 (ERAS) 50 (Control)	↓LOS (postop) :14.2 d ERAS; 18.7 d control; delayed gastric emptying: 1 ERAS; 3 control; morbidity: 12 ERAS; 24 control; mortality: 0 ERAS; 2 control; readmission rate: 4 ERAS; 4 control; reoperation rate: 5 ERAS; 5 control
Williamsson *et al*.[30] (2015)	41 (ERAS) 34 (Control)	↓LOS (postop) :10 d ERAS; 14 d control; delayed gastric emptying: 13 ERAS; 24 control; morbidity: 32 ERAS; 34 control; no mortality (both); readmission: 3 ERAS; 3 control
ERAS (pancreaticodudenectomy)		
Shao *et al*.[31] (2015)	325 (ERAS) 310 (control)	↓LOS (postop): 13.9 d ERAS; 17.6 d control; delayed gastric emptying: 29 ERAS; 52 control; overall complications: 127 ERAS; 173 control; readmission rate: 43 ERAS; 44 control
Zouros *et al*.[32] (2016)	75 (ERAS) 50 (control)	Delayed gastric emptying: 9 ERAS; 15 control; complications: 27 ERAS; 25 control; mortality: 3 ERAS; 2 control; readmission rate: 5 ERAS; 3 control; reoperation rate: 4 ERAS; 2 control
Bai *et al*.[33] (2016)	124 (ERAS) 63 (control)	Delayed gastric emptying: 11 ERAS; 10 control; complications: 84 ERAS; 46 control; mortality: 1 ERAS; 1 control; readmission rate: 11 ERAS; 2 control; reoperation rate: 4 ERAS; 1 control
Dai *et al*.[34] (2017)	68 (ERAS) 98 (control)	↓LOS (postop): 7.5 d ERAS; 12 d control; delayed gastric emptying: 0 ERAS; 11 control; ↓complications: 34 ERAS; 89 control; mortality: 0 ERAS; 0 control; readmission: 0 ERAS; 6 control; reoperation: 2 ERAS; 5 control
ERAS (Laparoscopic total/radical gastrectomy)		
Gowda *et al*.[35] (2014)	22 (ERAS) 25 (Control)	↓LOS: 78 h ERAS, 140 h control; early passage of flatus (37 vs. 74 h); no significant difference in complications; ↓serum CRP in ERAS [d 1: (52.4 vs 73.0 g/L; d 3: (126.1 vs 160.7g/L)]
Fujikini *et al*.[36] (2016)	40 (ERAS) 40 (Control)	HOMA-R index score >2.5 means insulin resistance; ↓HOMA-R score on 1st postop day (15 ERAS; 6.6 control)
Abdikarim *et al*.[37] (2016)	30 (ERAS) 31 (Control)	↓LOS (postop) 6.8 d ERAS; 7.7 d control↓Hospital charge; ↓complications 1 ERAS; 2 control
Liu *et al*.[38] (2016)	21 (ERAS) 21 (Control)	↓LOS (postop) 6.3 d ERAS; 7.8 d control; ↓time to first flatus 48 h ERAS; 60 h control; ↓hospital charge $4884 ERAS; $5626 control; ↓complications 11 ERAS; 6 control

Contd...

Table 1: Contd...

Surgery original study/year	Participants (*n*)	Outcome
Fang *et al*.[39] (2016)	33 (ERAS) 30 (Control)	↓LOS (postop) 11 d ERAS; 18.5 d control; ↓time to first flatus 60 h ERAS; 96 h control; ↓complications 2 ERAS; 2 control
Mingjie *et al*.[40] (2017)	73 (ERAS) 76 (Control)	↓LOS (postop) 6.38 d ERAS; 8.62 d control ↓Complications 2 ERAS; 2 control
Tanaka *et al*.[41] (2017)	73 (ERAS) 69 (Control)	↓LOS 9 d ERAS, 10 d control; ↓major postop complications (4.1% ERAS; 15.4% control); ↓costs of hospitalisation (JPY 1,462,766 vs JPY 1,493,930); ↑ physical activity 1st week post-surgery
ERAS (lung cancer surgery)		
Lai *et al*.[42] (2016)	24 (ERAS) 24 (Control)	↓LOS (hospital): 14 d (ERAS), 15.8 d (control); ↓total cost: 46.5 (ERAS), 45.5 (control); no in-hospital mortality in both groups Overall morbidity: 2 (ERAS) 5 (control)
Dong *et al*.[43] (2017)	17 (ERAS) 18 (Control)	↓LOS (hospital):18.1 d (ERAS), 27.4 d (control); ↓total cost: 29.9 (ERAS), 37.2 (control); no in-hospital mortality in both groups; overall morbidity: 4 (ERAS), 6 (control)
Huang *et al*.[44] (2017)	30 (ERAS) 30 (Control)	↓LOS (hospital): 14.1 d (ERAS), 17.3 d (control); ↓in-hospital mortality; ↓overall morbidity: 5 (ERAS), 12 (control)
Licker *et al*.[45] (2017)	74 (ERAS) 77 (Control)	↓LOS (hospital):10 d (ERAS), 9 d (control); ↓LOS (ICU): 0.7 d (ERAS), 1 d (control); overall morbidity: 27 (ERAS), 39 (control)
ERAS (open radical cystectomy)		
Persson *et al*.[46] (2015)	31 (ERAS) 39 (Control)	↓Time to first passage of stool ↓30-d readmission frequency
Collins *et al*.[47] (2016)	135 (ERAS) 86 (Control)	↓LOS (postop) 8 d ERAS; 9 d control; change in demographics with↓median age from 66 (control) to 70 years (ERAS)
Lin *et al*.[48] (2018)	124 (ERAS) 164 (Control)	↓ LOS (9.2 to 3.8 d), ↓hospitalisation costs from USD 7200 to USD 6100; ↓time to first water intake (2.5 h ERAS; 30.1 h control); first ambulation (8.7 h ERAS; 73 h control), first defecation (17 h ERAS; 81 h control)
ERAS (gynaecological) surgeries		
Modesitt *et al*.[49] (2016)	136 (ERAS) 211 (Control)	↓LOS (postop): 2 d ERAS; 3 d control; ↓ median intraop morphine equivalents (0.3 ERAS; 12.7 mg control) ↓Intraop (285 mL ERAS; 1250 mL control); ↓total complications (21.3% ERAS; 40.2% control)
PSH (Lean Six Sigma; posterior spinal fusion scoliosis surgery)		
Thomson *et al*.[50] (2016)	27 (PSH) 116 (Control)	↓LOS (5.2 vs 3.4 d); no difference in 30-d readmission rate; no mortality in either group↓Perioperative blood transfusion (35% vs 11%, OR=0.21)
PSH (total knee arthroplasty/total hip arthroplasty)		
Qiu *et al*.[51] (2016)	546 (Reference) 518 (PSH)	↓LOS (2.4 vs 3.4 d); ↑SNF bypass rate in PSH group (94% vs 80%); no difference in 30 readmission (1.2% vs 0.98%)
Vetter *et al*.[52] (2017)	1225 (Pre-PSH) 1363 (Post-PSH)	$432 and $601 decrease in direct nonsurgical costs for post PSH patients; ↑on-time surgery starts;↓anaesthesia related delays; ↓ day-of-surgery case cancellations

ERAS–Enhanced recovery after surgery; PSH–Perioperative surgical home; CRP–C-reactive protein; HOMA-R–Homeostasis model assessment-insulin resistance; ICU–Intensive care unit; LOS–Length of stay; OR–Odds ratio; Pul–Pulmonary; h–Hours; d–Days; THA–Total hip replacement; TKA–Total knee replacement

an ERAS pathway for colorectal surgery which were hitherto grey areas of the ERAS protocol, ushering an era of evidence-based perioperative medicine.[53-59] Return to intended oncotherapy is another recent parameter and time to adjuvant chemotherapy post colorectal cancer surgery is associated with an improved survival rate.[60] Besides elective colorectal surgery, ERAS Society guidelines (19 in number; available free from http://erassociety.org website) are now available for pancreaticoduodenectomy, rectal/pelvic surgery, hepatic resection, head and neck surgery with free-flap reconstruction, oesophageal, gastric and lung cancer surgery, radical prostatectomy, gynaecooncologic surgery, breast reconstruction and bariatic surgery. Indian Association for Parenteral and Enteral Nutrition is currently trying to develop India-specific ERAS guidelines (http://www.iapen.co.in).

PSH MODEL

PSH is a patient-centred, team-based model, modifying healthcare economics, policy and organisation, adopted by the American Society of Anaesthesiologists, to enhance quality and patient safety, decrease costs, augment value and do away with fragmented and variable care.[61] Many hospitals adopt the 'Lean Six Sigma' approach to embrace

PSH.[50] 'Lean' implies reduction of waste by rigorous standardisation methods. 'Six Sigma' signifies boosting customer/patient satisfaction by eradicating deficiencies and minimising divergence from the target goal. Low-risk patients need not be prescribed high-cost investigations and high-risk patients should undergo all investigations 1 day prior to surgery to avoid last-minute cancellations and rescheduling. Unnecessary preoperative investigations are multifactorial.[62] They maybe an institutional protocol/practice tradition, be prescribed in the belief that other physicians require them or to surmount medicolegal aspects. Concerns about surgical delays and cancellations, and lack of guidelines are other factors which are addressed by the PSH model.

An ambulatory surgery PSH for laparoscopic cholecystectomy was introduced by Qiu *et al*.[14] into a Kaiser Permanente model of care. They found a shorter LOS (162 vs 369 days) and reduced unplanned hospital admission (1.7% vs 8.5%) for patients admitted after PSH model implementation.

Under the same integrated delivery system, the same authors developed a PSH model for total knee arthroplasty[51] and compared it with the older fast-track model. A reduced LOS of 2.4 ± 2.1 days for PSH versus 3.4 ± 2.9 days for fast-track was observed. The skilled nursing facility bypass rate was 94% in the PSH group compared with 80% in the reference group.

Garson *et al*.[63] implemented a PSH model for elective total hip and knee arthroplasty (THA and TKA) with similar results. Vetter *et al*.[52] in the same surgical subset found a $432 and $601 decrease in direct nonsurgery costs for the THA and TKA patients, respectively, increased on-time surgery starts and reduced anaesthesia-related delays and day-of-surgery case cancellations using a PSH model with the anaesthesiologist as the 'perioperativist'.

In a PSH model for posterior spinal fusion surgery for idiopathic scoliosis in adolescents,[50] LOS decreased from 5.2 to 3.4 days in PSH patients who were significantly less likely to undergo perioperative blood transfusion (35% vs 11%; OR = 0.21) with significantly lower (2336 vs 1393 mL) crystalloid infusion.

Blueprints of two fresh PSH models based on a review of existing PSH models for other surgery types and tempered with the authors' experience in the field have been described specifically for robotic surgery and major head and neck oncosurgery [Tables 2 and 3].

THE HOSPITALIST ANGLE

Till date, there exists only one society dedicated to hospital medicine (Society of Hospital Medicine), headquartered in Philadelphia, USA, with roughly 16,000 members who call themselves 'hospitalists'.[64] It is very active and has already published practice guidelines for perioperative care, publishes an official journal (Journal of Hospital Medicine) and also offers Fellowships and a Masters degree in Hospital Medicine. Teamwork, QI and leadership are the three pillars on which the hospitalists have built their edifice. Members include physicians, practice administrators, nurse practitioners, physician assistants and pharmacists. Hospitalists are catering to a felt-need of the patients by filling a void left by office-based internal medicine physicians, surgeons and anaesthesiologists and are emerging as leaders of perioperative medicine care team. Progressive loss of influence of anaesthesiologists is foreseen if we do not embrace perioperative medicine amidst plenty of other takers, like the hospitalists.

Despite this threat, anaesthesiologists are still a divided lot!

Voices in favour of embracing hospital medicine

- Mission and vision: Keeping intraoperative medicine as the principal mission of anaesthesiology, the broader vision should be involvement in preoperative optimisation and postoperative care which is vital for the specialty's growth and evolution
- Widening vistas of knowledge: Perioperative medicine signifies a latitudinal increase in the anaesthesiologists' medical knowledge providing better insight into chronic comorbidities translating into better patient management and overall QI across the continuum of perioperative care
- Reduced last-minute case cancellations: A well-engineered, preoperative evaluation clinic with an anaesthesiologist as its dynamic director can reduce both the number of requests for referrals/consultations and the number of surgical cancellations attributable to inadequate preoperative preparation

Table 2: Perioperative Surgical Home model for robotic radical hysterectomy and robot-assisted radical prostatectomy

Timing	Technique	Technique	Technique	Technique
Before Sx	Standardise duration of Sx to 2 h	Two robotic OTs assigned for RH cases taken up in batches of 2-3 per OT	Real-time feedback on cancelled/added/ rescheduled cases	Patient shifted to OT with minimal waiting period for the patient and without wastage of OT time
Presurgical care	Patient education on available alternative Sx	Informed consent after disclosing complications including conversion to open Sx	Infection prevention strategies discussed with patient	Surgeon enters admission orders by 5 PM a day prior to Sx
preanaesthetic care	Triage system to identify patients requiring prehabilitation in preadmission clinics; CPET	PAC checkup 1-7 d before Sx Discontinue anticoagulants as per guidelines	Optimisation of medication (HTN, DM, hypothyroid, OSA) and screening for glaucoma and raised ICP	Clear Malto dextrin drink (Ensure/Gatorade) 400 mL or 50 g; 2 h before Sx
Communication	Centralised electronic system with access to patient information for all stakeholders	Team member and team leader identification	Anaesthesia technician assigned for the case	Cleaning staff, OT technician and nurse to start cleaning and set up OT as soon as incision is closed
Robot and instruments on day of Sx	Standardisation of equipment and instruments across surgeons	Availability of minimum number of instrument trays/sets required to avoid the need for processing/ sterilisation between cases	All trays complete and in working order	Tray available for conversion to open Sx
Preop	Activation of multimodal pain and PONV prevention protocol; iv PCM 1 g before docking	Combination approach for positioning patient in ST position: placement of a horizontal sheet in the anatomical concavity of the back; patient's torso and hips on a hypoallergenic warming gel pad with a high coefficient of friction; sandwiching gel pads between the shoulder and brace; placing shoulder braces more medially (flush with the head) VTE prophylaxis Antibiotic 1 h before Sx		Padding of pressure points
Intraop	Intraop timeout Safety checklist signed by surgeon and anaesthetist in CPRS (electronic records)	VCV keeping peak airway pressure <30 mmHg Switch over to PCV to avoid barotrauma in head low position	Remember to reduce set control pressure/switch over to VCV once patient is supine again	Glitch book used if problems with docking of robot
	Fluid restriction, 8 mg dexamethasone, 10-20 mg furosemide and/or mannitol to prevent POCD	Maintaining depth of anaesthesia with BIS; keeping <10 PTCs with PNS to avoid patient movement with robot docked	Fluid chasing and slight head up position after dedocking and supination	Sign out after final instrument and swab count coincides with initial count
Postop	Quick dressing and handover to OT anaesthesiologist for reversal and handover to SICU anaesthetist	SICU complications attended to timely by anaesthetist; Aldrete discharge criteria met for discharge to ward; PASS score >13 for discharge home Prescription analgesic in discharge order	VAS 1-3: diclofenac 50 mg 8 hourly VAS 4-6: tramadol 50 mg SOS and 6 hourly VAS 7-10: fentany l 50 µg SOS	For PONV IV ondensetron 4-8 mg and/ or IV dexamethasone 4-8 mg Avoid morphine Removal of nasogastric tube early enteral feed
Preparedness for next case	One member of OT cleaning staff immediately available on incision closure	Next patient trolley immediately wheeled into the OT by OT technician the moment the cleaning staff exits	Preoperative checklist completed timely by surgeon and anaesthetist	Real-time next-patient status update with information on potential delays
Post discharge care	Follow-up with phone calls (d 3 and d 5); clinical visits	Tracking of emergency care returns and noting the causes	Any requirement for readmission	Monthly reviews by robotic committee

CPET–Cardiopulmonary exercise testing; DM–Diabetes mellitus; HTN–Hypertension; Intraop–Intraoperative; OSA–Obstructive sleep apnoea; OT–Operation theatre; PONV–Postoperative nausea and vomiting; Postop–Postoperative; SICU–Surgical intensive care unit; Sx–Surgery; VAS–Visual analog score; VTE–Venous thromboembolism

- Monetary benefit: Significant cost savings can be achieved by reducing unnecessary testing and resource utilisation
- Improved interspecialty communication
- Differentiation of anaesthesiologists from nonphysician anaesthetists: This is by virtue of differences in the quality of perioperative care provided
- Seamless care transitions leading to enhanced patient care.

Voices of dissent

Anaesthesiologist as perioperativist is a recent development spelling change in the existing healthcare system. Resistance to change being a normal phenomenon, there are challenges ahead: challenges from within the anaesthesia community by the anaesthesiologists themselves to accept this new role and challenges from other specialities who might feel threatened by their dwindling role in perioperative care.

Table 3: PSH model for major head and neck Sx requiring free-flap reconstruction

Timing	Technique	Technique	Technique
Before Sx	Case to be started as the first case to allow adequate time for assessing free-flap perfusion	Real-time feedback on cancelled/ added/rescheduled cases	Patient shifted to OT with minimal waiting period for the patient and without wastage of OT time
Presurgical care	Informed consent after disclosing complications including flap necrosis, need for tracheostomy and cosmetic disfigurement	Infection prevention strategies discussed with patient	Surgeon enters admission order by 5 PM the day prior to Sx
Preanaesthetic care	PAC checkup 1-7 d before Sx Discontinue anticoagulants as per guidelines Lab investigations CBC, KFT incl S. electrolytes LFT incl. S. proteins Coagulation profile RBS, TSH, CXR, ECG (echo if post CT; stress test for CAD) Viral markers	Patient counselled about postoperative retention of ETT and inability to speak with ETT *in situ* Difficult airway assessment and management plan especially for SMF patients with restricted mouth opening and redo cases (C Mac Dblade; FOB)	Patient counselled about awake fibreoptic intubation under local anaesthetic nerve blocks where required PONV prevention Activate multimodal analgesia (including preemptive analgesia) on arrival
Communication	Avoid taking IV access, CVP or arterial line from the limb from which free flap is to be harvested	Anaesthesia technician assigned for the case	Site and side of Sx marked
Instruments on day of Sx	Availability of venous couplers for anastomosis, angle plates/implants	Instruments tray verified to be complete and in working order for the day	Difficult airway cart C Mac D blade videolaryngoscope FOB; bougie
Preop	Medication optimisation (HTN, DM, hypothyroid, OSA)	Nostril selection (digital method; MRI imaging on display; POC USG)	Activate multimodal analgesia (including preemptive analgesia) on arrival (1 g PCM iv)
Intraop	Nostril preparation with oxymetazoline drops Heparin 2500 IU after harvesting but before free-flap insertion	Flexometallic tube Hypothermia prevention (warming blanket, fluid warmer) to improve rheology	Point-of-care blood sugar and free-flap sugar to be estimated and a difference of <10 mg% to be maintained
Postop	Noting time of extubation over bougie following morning	Early ambulation Early removal of urinary catheter	No routine lab investigations (need based on consensus)
Quality improvement post discharge	Tracking of emergency care returns and noting the causes	Noting incidence of reexploration/ flap revision/reanastomosis for flap necrosis or any bleeders causing haemodynamic compromise	Monthly review by head and neck Sx review committee and feedback to stakeholders: oncosurgeon, plastic surgeon anaesthetist, nurse

PSH–Perioperative Surgical Home; CAD–Coronary artery disease; CT–Chemotherapy; DM–Diabetes mellitus; FOB–Fiberoptic bronchoscope; HTN–Hypertension; OSA–Obstructive sleep apnoea; OT–Operation theatre; PCM–Paracetamol; POC–Point of care; PVI–Pleth variability index; RT–Radiotherapy; RIOT–Return to intended oncotherapy; SVV–Stroke volume variation; USG–Ultrasound

Perioperative medicine is not a coveted field for many anaesthesiologists. An 'anaesthetist' strictly means a person who delivers anaesthesia during the intraoperative period. When the surgeon pays us sufficiently for our sevices within the OT, why should we venture out of it? Why should we shoulder the additional responsibility of preoperative optimisation and postoperative care? The OT itself has such long working hours. Why should we reduce the quality of our life by assuming this extra burden? The temptation to avoid change is substantial, due to the comfortable lifestyle and financial reward of practice limited to the OT without hassles of admissions and discharges.

Perioperative medicine requires broader training across several specialities possibly translating into 'lengthened training periods' in this era of 'bridging courses' as short as 6 months. The perioperative period is ill-defined. With the power of perioperative medicine comes'responsibility,' which many anaesthesiologists are reluctant to shoulder.

PRACTICAL SOLUTIONS

All anaesthesiologists need not embrace perioperative medicine. A new superspeciality called 'perioperative anaesthesia' can be developed within anaesthesia just like neuroanaesthesia, cardiac anaesthesia and oncoanaesthesia. Anaesthesiologists with an inclination, aptitude and enthusiasm towards perioperative medicine can embrace this branch.

Till then, in perioperative clinics, a single anaesthesiologist should not be expected to give expert advice on all the aspects of prehabilitation. Rather, a group of anaesthesiologists each heading a specific

field (diabetes clinic, smoking cessation clinic, pain clinic, nutrition optimisation clinic) can collectively share the responsibility of perioperative care.

INDIA-SPECIFIC HURDLES

- Lack of awareness about the PSH concept
- Reluctance and partial acceptance since evidence-based recommendations may clash with their personal belief and traditional teaching
- Lopsided distribution of existing physicians especially the anaesthetists, most of them being concentrated in urban areas. India has only 1.27 anaesthesiologists for every 100,000 people, according to data from the World Federation of Societies of Anaesthesiologists.[65] Most of them reside in cities
- Paucity of trained allopathic physicians and a poor doctor–patient ratio in India has led to contemplation of implementing 'bridging courses' from alternative medical therapy to allopathy
- Resource-constrained setting with paucity of material resources and monetary funds. Nonavailability of trained personnel, equipment and monitoring gadgets at district level and peripheral hospitals
- Pressure to cater to a burgeoning patient population with time and space limitations: Sheer quantity of cases makes quality take a backseat
- Urban sector corporate hospitals are better poised as far as infrastructure is concerned to adopt the EPOC pathway. Advent of medical tourism and catering to foreign patients is another factor in adopting EPOC in these hospitals.

Against this background of limited availability/acute shortage of trained anaesthesiologists, will the Indian healthcare system be able to integrate perioperative medicine with anaesthesia? Can the best be achieved as has been done in the developed nations? Although excellent for patients in terms of quality of care and costs, it is not possible to implement it without significant changes in the teaching and training curriculum involving a major role of professional bodies such as Medical Council of India and Indian Society of Anaesthesiologists. The medicolegal status of anaesthesiologists as perioperativists merits reconsideration.

Anaesthesia is the common platform on which the minarets of different branches of surgery stand which makes the anaesthetist best positioned to embrace perioperative medicine.

A new superspeciality for anaesthesiologists called 'perioperative medicine', akin to neuroanaesthesia or oncoanaesthesia, is the need of the hour.

EPOC pathways are the key to reducing postoperative morbidity and mortality.

EPOC pathways for emergency surgery may narrow the wide difference in mortality rates between elective and emergency surgery.

Against a backdrop of acute shortage of trained anaesthesiologists, it is debatable whether our Indian healthcare system is able to integrate perioperative medicine with anaesthesia and achieve the best as has been done in the West.

SUMMARY

Intensivists have taken over critical care medicine. Before the powerful, lucrative and emerging field of perioperative medicine goes the critical care way we must wake up for the sake of our speciality. EPOC pathway for emergency surgery should be the next target after devising practical and cost-effective EPOC pathways for elective surgery with anaesthesiologist as the team leader. Urban sector corporate hospitals can lead the way in India.

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