



# Enhanced recovery for abdominal surgery **Clinical Pathway**



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Zaragoza

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# Authorship and collaborations

## Clinical Pathway Working Group

<b>José María Calvo Vecino</b>	Spanish Society of Anaesthesiology and Reanimation (SEDAR) Hospital Universitario Infanta Leonor. Vallecas. Madrid
<b>Emilio del Valle Hernández</b>	Spanish Association of Coloproctology (AECp) Spanish Multimodal Rehabilitation Group (GERM) Hospital General Universitario Gregorio Marañón. Madrid
<b>José Manuel Ramírez Rodríguez</b>	Spanish Multimodal Rehabilitation Group (GERM) Hospital Clínico Universitario Lozano Blesa. Zaragoza
<b>Carmelo Loinaz Seguro</b>	Spanish Society of Parenteral and Enteral Nutrition (SENPE) Hospital Universitario 12 de octubre. Madrid
<b>Carlos Martín Trapero</b>	Spanish Association of Surgical Nursing (AEEQ) Hospital Clínico Universitario San Carlos. Madrid
<b>Carmen Nogueiras Quintas</b>	Spanish Society of Nursing and Surgery (SEECIR) Hospital Universitario de Fuenlabrada. Madrid
<b>Alfredo Rodríguez Antolín</b>	Spanish Association of Urology (AEU) Hospital Universitario 12 de Octubre. Madrid
<b>Elías Rodríguez Cuéllar</b>	Spanish Association of Surgeons (AEC) Hospital Universitario 12 de octubre. Madrid
<b>Juan José Hernández Aguado</b>	Spanish Society of Gynaecology and Obstetrics (SEGO) Hospital Universitario Infanta Leonor. Vallecas. Madrid
<b>Pedro Ruiz López</b>	Project methodology coordinator. Hospital Universitario 12 de octubre. Madrid

## Working Group collaborating in the systematic review of scientific literature

<b>Javier Ripollés Melchor</b>	Spanish Society of Anaesthesiology and Reanimation (SEDAR) Spanish Group of Multimodal Rehabilitation (GERM) Hospital Universitario Infanta Leonor. Vallecas. Madrid
--------------------------------	--

<b>Alfredo Abad Gurumeta</b>	Spanish Society of Anaesthesiology and Reanimation (SEDAR) Hospital Universitario La Paz. Madrid
<b>Javier Longás Vailén</b>	Society of Anaesthesiology and Reanimation (SEDAR) Spanish Group of Multimodal Rehabilitation (GERM) Hospital Clínico Universitario Lozano Blesa. Zaragoza
<b>Alejandro Suárez de la Rica</b>	Spanish Society of Anaesthesiology and Reanimation (SEDAR) Hospital Universitario La Paz. Madrid
<b>Rubén Casáns Francés</b>	Spanish Society of Anaesthesiology and Reanimation (SEDAR) Spanish Group of Multimodal Rehabilitation (GERM) Hospital Clínico Universitario Lozano Blesa. Zaragoza
<b>Eugenio Martínez Hurtado</b>	Spanish Society of Anaesthesiology and Reanimation (SEDAR) Hospital Universitario Infanta Leonor. Vallecas. Madrid
<b>Montserrat Ortega Urbaneja</b>	Spanish Society of Nursing and Surgery (SEECIR) Hospital Universitario Infanta Leonor. Vallecas. Madrid

## Technical Coordination

<b>Paloma Casado Duráñez</b>	Assistant Director General for Quality and Cohesion. Ministry of Health, Social Services and Equality.
<b>M.<sup>a</sup> Ángeles López Orive</b>	Head of Area. SG for Quality and Cohesion. Ministry of Health, Social Services and Equality.

## Assessment of compliance with quality criteria for a Clinical Pathway

<b>Silvia Vázquez Fernández del Pozo</b>	Aragonese Institute of Health Sciences (IACS) Biomedical Research Centre of Aragon (CIBA)
<b>Juan Ignacio Martín Sánchez</b>	Aragonese Institute of Health Sciences (IACS) Biomedical Research Centre of Aragon (CIBA)
<b>Juan Manuel García-Lechuz Moya</b>	Aragonese Institute of Health Sciences IACS Biomedical Research Centre of Aragon (CIBA)

**Contact Person: Jose Manuel Ramírez Rodríguez.** Surgery Service. Hospital Clínico Universitario "Lozano Blesa". Zaragoza. ([jramirez@unizar.es](mailto:jramirez@unizar.es))

**DECLARATION OF INTEREST:** All members of the Clinical Pathway working group have made the declaration of interests presented in **annex 7**.

The assessment of compliance with quality criteria of this document has been conducted in agreement with the collaboration agreement signed by Carlos III Health Institute, an independent organisation of the Ministry of Economy and Competitiveness, and the Aragonese Institute for Health Sciences, within the framework of the development of activities of the Spanish Network for Health Technology Assessment Agencies and NHS Benefits, financed by the Ministry of Health, Social Services and Equality. The authors of the document have not received any type of economic compensation for their work.

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# Executive summary

Multimodal surgical rehabilitation, also known as Enhanced Recovery Programme (ERP) or in the English-speaking world as Fast-track Surgery or Enhanced Recovery After Surgery (ERAS), entails the application of a series of perioperative procedure measures and strategies aimed at patients who are going to undergo a surgical procedure with the objective of reducing secondary stress caused by the surgical intervention and thus achieve enhanced recovery of the patient and decrease complications and mortality.

The ERP combine a series of elements whose aim is to optimise recovery and reduce the response to surgical stress. They were introduced approximately 10 years ago following some first favourable results, based on scientific evidence from randomised studies.

The ERP starts at the time of diagnosis and the aim is to recognise patients' individual needs to prevent complications and optimise their treatment before, during and after surgery.

To be able to successfully carry out the ERP there must be close collaboration among all specialists participating in the process, as well as with the actual patient and relatives.

The increasing demand for major surgery in high risk patients requires new improvements that must include a specific evidence-based approach per procedure. This must be up-to-date and interdisciplinary within the bases of the ERP. The standardisation of these measures is beneficial for patients, professionals and centres, and it can be done following protocols at state level, as shown by previous projects in other countries, with good results.

Therefore, the main objective of this document is to provide professionals with some recommendations based on scientific knowledge and on the consensus of the different scientific societies involved to implement and assess ERP in abdominal surgery. Given that this is a general document, individual aspects must be incorporated into each specific procedure when applicable.

The following inclusion criteria have been considered: patients undergoing surgical procedures that are not considered as Major Outpatient Surgery, between the ages of 18 and 85, and ASA  $\leq$  III. Some of the procedures indicated are: Coloproctology surgery, gastrectomy, gastric by-pass, hysterectomy, gynaecological cancer surgery, prostatectomy, cystectomy, urological cancer treatment, etc.

To develop this document, systematic reviews were conducted of those points with respect to which there are no Clinical Practice Guidelines or when there was no clear acceptance of verifiable scientific evidence.

Different search strategies were carried out using the PRISMA protocol. The GRADE methodology was chosen to grade the Scientific Evidence based on which Recommendations were made.

The document also includes the list of recommendations with articles of reference, as well as the level of evidence and degree of recommendation. Furthermore, a table of indicators to measure the process and results is provided. A patient satisfaction questionnaire has been designed to measure perceived quality. Finally, an information text is provided about the general care process for patients.

# Introduction

Multimodal surgical rehabilitation, also known as Enhanced Recovery After Surgery (ERAS) or Fast-track Surgery, entails the application of a series of perioperative procedure measures and strategies aimed at patients who are going to undergo a surgical procedure with the objective of reducing secondary stress caused by the surgical intervention and thus achieve enhanced recovery of the patient and decrease complications and mortality<sup>1,2</sup>.

Multimodal rehabilitation protocols review traditional preoperative procedure practices, evaluating the specific key points of each type of surgery and analysing their scientific evidence. The advantages of these protocols have been repeatedly demonstrated in a good number of randomised clinical trials and meta-analyses.

Despite these advantages, Multimodal Rehabilitation Programmes (MRP) are relatively little known and have important implementation problems because, as we have commented, they have to put up with traditional attitudes and necessarily require collaboration among different professionals.

The Spanish Multimodal Rehabilitation Group (GERM) was created in our country in 2007. Its foundational objectives included the dissemination, implementation and maintenance of MRPs in the different areas of Surgery. In this sense, worthy of note is the close collaboration that has existed since the beginning of 2013 between the GERM and the Ministry of Health, Social Services and Equality to develop a care plan aimed at reducing variability in clinical practice. Given the multidisciplinary nature, other scientific societies involved have been incorporated into this initiative to finally achieve this consensus document.

This work aims to offer an interdisciplinary care plan to improve postoperative procedure rehabilitation and recovery in Major Abdominal Surgery, maintaining the patient's safety and optimising the use of resources.

It will thus be an instrument that addresses the organisation of actions in the event of clinical situations that present a predictable evolution. It describes the steps that must be followed, it establishes the sequences in time of each one of them and defines the responsibilities of the different professionals that are going to intervene.

## PAST HISTORY

One of the major progresses that have been made lately in scheduled surgery is the introduction of early rehabilitation or multimodal rehabilitation programmes (MRP), also known as "fast-track" and called Enhanced Recovery Programmes (ERP) by the Developing Group of this document.

The ERPs combine a series of elements whose aim is to optimise recovery and reduce the response to surgical stress. They were introduced approximately 10 years ago following some first fa-

avourable results, based on sufficient evidence derived from randomised studies. They start at the time of the diagnosis and their aim is to recognise patients' individual needs to optimise their treatment before, during and after surgery<sup>3,4,5,6,7</sup>.

The close collaboration of all specialists participating in the process, as well as of the actual patients and their relatives has proved to be essential. Studies conducted focus on adopting a series of measures that make up the protocol. As a result, there is a certain variability in the randomised studies performed as none of them adopts all the suggested measures. Sufficient consensus exists to the extent that the implementation of these protocols is beneficial for patients, as shown by recent meta-analyses, and that their benefit is directly related to compliance with all the phases of the protocols. In this regard, the following points must be considered<sup>8-12</sup>.

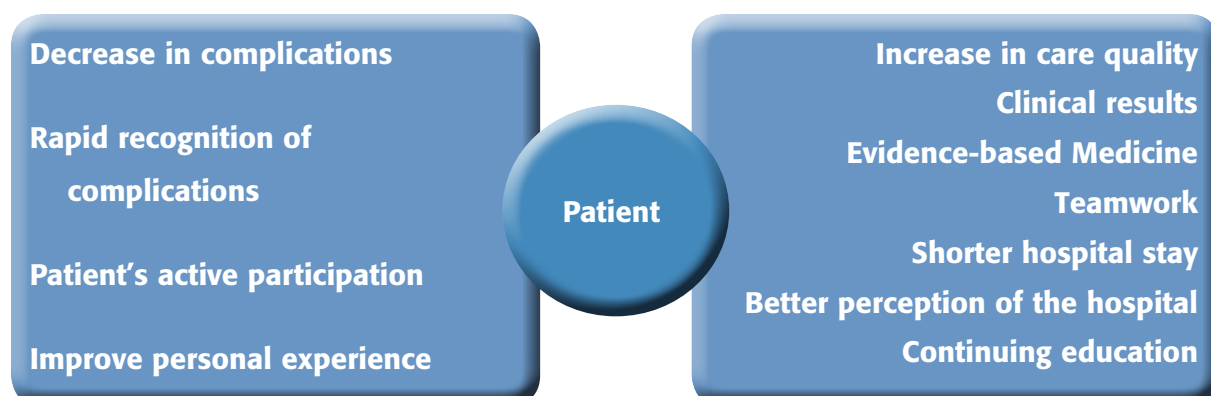
- **1. All patients who participate in the protocol must start it from preoperative procedure. This will enable them to recover faster from the surgery and from the postoperative procedure convalescence, reducing physical and psychological stress as much as possible.**
- **2. Prior preparation of patients is essential, making sure that they are in the best possible conditions, identifying personal risks during the preoperative procedure.**
- **3. The treatment is comprehensive and includes pre-, intra- and postoperative procedure measures in which they actively participate.**
- **4. Patients have an active role and they must assume responsibility for improving their recovery.**

### **Key Aspects**

### **BENEFITS OF THE MRP OR ERP**

MRPs have shown, in Services and Centres that have routinely adopted them, a significant improvement in the patient's quality of life (the patient's hospitalisation and treatment experience). The clinical results, in terms of postoperative procedure complications, have also improved. Furthermore, as the MRPs achieve a reduction in complications and homogeneous management criteria, they succeed in significantly reducing the hospital stay and potential complications associated with hospitalisation.

### **Associated Benefits**



## JUSTIFICATION AND OBJECTIVES

The increasing demand for major surgery in high risk patients requires new improvements that must include a specific evidence-based approach per procedure. This must be up-to-date and interdisciplinary within the bases of the ERAS. The standardisation of these measures is beneficial for patients, professionals and centres, and it can be done following protocols at state level, as shown by previous projects in other countries, with good results<sup>13,14</sup>.

This document deals with clinical aspects related to the perioperative management of the patients, in an attempt to homogenise this care and improve postoperative procedure rehabilitation or recovery, by reducing surgical complications and improving the perceived quality of life of these patients. It is considered that, to reach this objective, part of the normal management that these patients receive must be modified, both during the pre-surgical stage and in the intra-operative stage and postoperative procedure recovery.

The scope of action of this Clinical Pathway covers all patients over the age of 18, in whom major abdominal surgery has been indicated.

Enhanced Recovery programmes are the future of effective surgery but they require greater collaboration among surgeons, anaesthesiologists, nutritionists, nurses, etc., to ensure compliance with all protocol measures, as this has proved to achieve the best results and will permit advancing and improve the programmes<sup>15,16</sup>.

Therefore, the main objective of this document is to provide professionals with some recommendations based on scientific knowledge and on the consensus of the different scientific societies involved to implement and assess enhanced recovery programmes in abdominal surgery. Given that this is a general document, individual aspects must be incorporated into each specific procedure when applicable. However, we consider that having the proper guidelines for this type of techniques is useful, as it may help start up these programmes that have proved to be useful for patients, as well as to improve interdisciplinary work.

## TARGET POPULATION

It not only addresses health professionals who are directly involved in the care of surgical patients, that is, surgeons, anaesthetists, and nurses, but all those professionals who, in some way or another, are related to the interdisciplinary treatment of these patients, such as nutritionists, stomatherapists, physiotherapists, rehabilitators, digestologists, radiotherapists, oncologists and pathologists. As effectiveness (reduction of hospital stay, as well as optimisation of the use of other resources) is one of the advantages of these programmes, we believe that they may be useful for administrators, clinical managers and quality coordinators. Finally, due to the characteristics of ERP, where patients play a very active role, they are also targeted, and in this sense, we believe that primary care physicians (PCP) must also be familiar with them.



# Inclusion and Exclusion Criteria

Although there is no evidence and other patients could also benefit, these criteria are recommended to launch the project:

## INCLUSION CRITERIA

Major Abdominal Surgery procedures, not subject to be operated by MAS and that satisfy the following criteria:

- Age: 18-85 years.
- Adequate cognitive state (able to understand and collaborate).
- ASA I, II and III.

## EXCLUSION CRITERIA

- Urgent surgery.
- Paediatric patient.





# Objectives

- Describe the process to develop the Enhanced Recovery for Abdominal Surgery Clinical Pathway.
- List the guidelines of the Enhanced Recovery for Abdominal Surgery Clinical Pathway that deals with aspects related to the perioperative management of the patient, in order to homogenise care and requirements according to available scientific evidence.
- Provide professionals with some recommendations based on scientific knowledge and on the consensus of the different Scientific Societies involved to implement and assess enhanced recovery programmes in abdominal surgery.
- Present the Enhanced Recovery for Abdominal Surgery Clinical Pathway documentation for use and implementation at any Health institutions, and help adapt it to the singularities of the area.
- Act as starting point to contribute to the start-up of Enhanced Recovery Programmes, in any Abdominal Surgery surgical procedure, requiring the incorporation of specific aspects and its singularities.



# Methodology

## DEVELOPMENT PROCESS

To develop this document, systematic reviews were conducted of those points with respect to which there were no Clinical Practice Guidelines or when there was no clear acceptance of verifiable scientific evidence. These systematic reviews and meta-analyses were performed in agreement with PRISMA methodology. Systematic searches were carried out on Medline PubMed, Embase and the Cochrane Library.

Studies that satisfied the inclusion criteria were examined thoroughly and were submitted to quantifiable analyses.

The PRISMA protocol was used to carry out different search strategies (latest update in October 2014) to identify relevant studies that satisfied the inclusion criteria, using EMBASE, MEDLINE and Cochrane Library. There were no restrictions in terms of date or language of publication.

Manual searches for additional references were made to identify all the review articles as well as the evidence-based Clinical Practice Guidelines and Recommendations, comparing them with the Agree II instrument, of May 2009<sup>a</sup>.

Two independent researchers assessed each title and abstract of the systematic reviews carried out, in order to reject any irrelevant Randomised Clinical Trial (RCT) and identify potentially relevant ones. These RCTs were analysed and those that satisfied the inclusion criteria selected in each case or topic were meticulously selected. The data were extracted from the RCT by two different researchers and any discrepancy considered was assessed, requiring further analysis and confirmation by a third researcher. The authors reviewed the data analysis in order to avoid transcription errors.

The GRADE methodology<sup>17</sup> was chosen to grade the Scientific Evidence based on which Recommendations were made.

At the end of the development process, the Enhanced Recovery for Abdominal Surgery Clinical Pathway will contain the following documents:

- 1) **Time matrix** with all the activities and operations carried out on the patient during the entire care process. All the actions and the person responsible for them must be registered and signed.
- 2) **Nursing care and treatment record sheet**

a. AGREE Next Steps Consortium (2009). The AGREE II instrument – Online version. Consulted at <http://www.guiasalud.es>

- 3) **Variations sheet**
- 4) **Information Sheet for patient**
- 5) **Recommendations on discharge**
- 6) **Satisfaction survey**
- 7) **Assessment indicators**

The first three points of the documentation indicated, are completed by all professionals involved, leaving a record of it by registering the data and signature of the person responsible for each activity.

It is important to point out that all the causes that support the fact that the patient cannot following the Clinical Pathway guidelines and must abandon this care route, are registered and notified on the variations sheet. These may depend on the patient, professional, organisation, or institution, etc. For example, test not carried out within the time established in the CP, appearance of complications that do not permit continuing with the care specified in the Clinical Pathway.

The Clinical Pathway forms part of the patient's clinical records, when applied at any institution.

The following Clinical Pathway documents (Time matrix, algorithms, summary recommendations table) will be enclosed at the end of the document as Annex, in order to make consultation easier and improve the usefulness of the document.

# CARE PROCESS

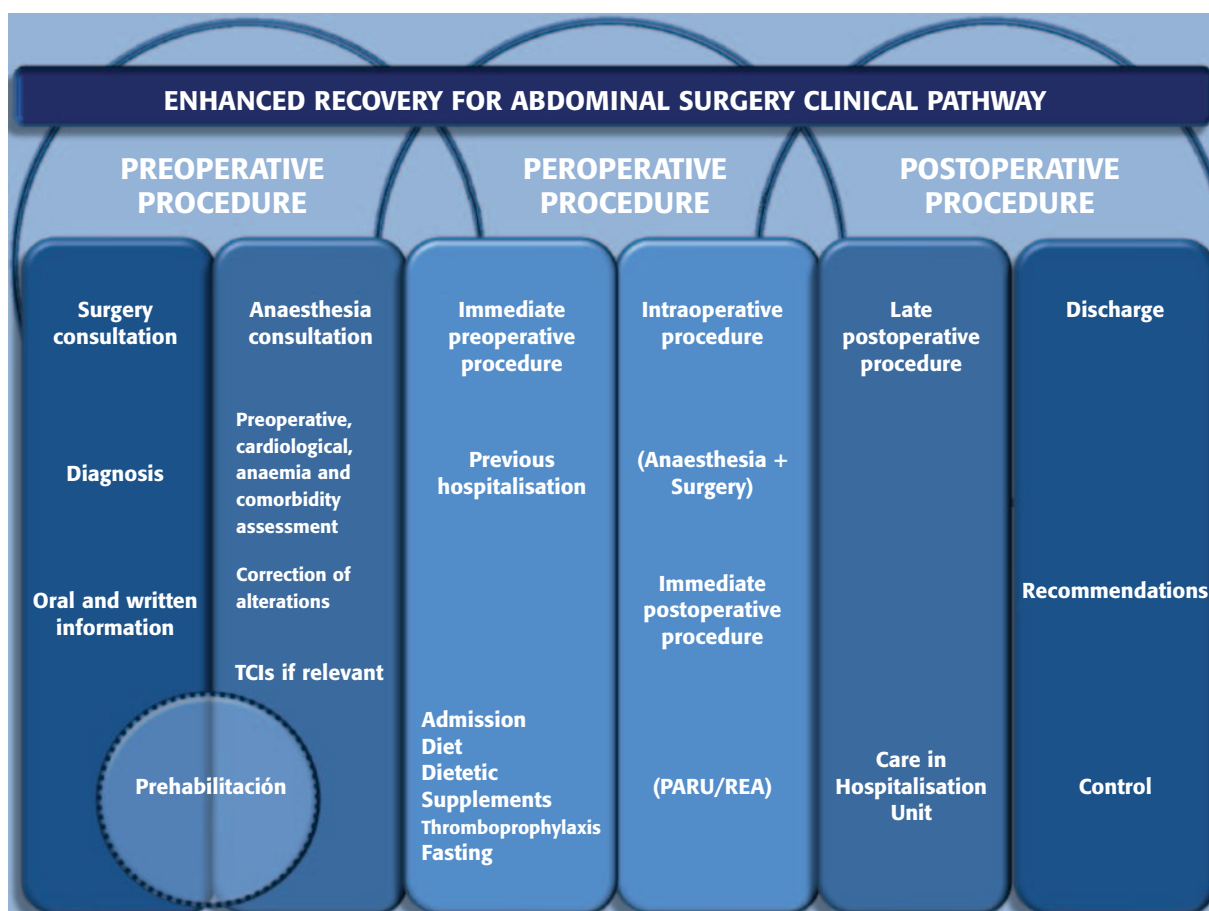
## OVERVIEW

Table 1. Process Overview

TIME	PROTOCOL	RESPONSIBILITY
<b>Prior to admission</b>	Preoperative procedure evaluation. Nutritional, cardiological, anaemia optimisation and co-morbidity, if relevant.	Surgeon + anaesthesiologist
<b>Immediate preoperative</b> <i>(preferably without admission)</i>	Dietetic adaptation Start thromboembolic prophylaxis* 6 hours without solid food and 2 hours without clear liquid <i>Mechanical preparation is not necessary in colon surgery, and its use is selective in rectum surgery.</i> <b>*If the patient is admitted the previous afternoon, this will be carried out when admitted.</b>	Anaesthesiologist + Nursing + Surgeon
<b>Preoperative</b>	<b>Immediate preoperative procedure</b> Cleansing enema 7 am (in rectum-sigma resection in those cases where indicated) Placement of compression stockings or intermittent pneumatic compression, depending on thromboembolic risk Carbohydrate drink supplement: 12.5% maltodextrins 250 cc 2 hours prior to operation Prophylactic administration of antibiotic 1 hour prior to surgical incision when this is indicated (or in operating theatre)	Nursing

TIME	PROTOCOL	RESPONSIBILITY
<b>Preoperative</b>	<b>Intraoperative procedure</b> Insertion of epidural catheter in open surgery Anaesthetic induction FiO <sub>2</sub> 0.6-0.8 oxygenisation Haemodynamic optimisation via goal-directed fluid therapy (GDFT) Fluid therapy in continuous balanced solution perfusion (3.5 ml/kg/h for laparoscope; 7 ml/kg/h for laparotomy) Bladder catheterisation if required Minimally invasive surgery (whenever possible) No NG intubation Active warming with thermal blanket and fluid heater Postoperative nausea and vomiting prophylaxis according to Apfel scale No drainage Infiltration of laparoscopy ports or blockage of transverse abdomen plane (TAP) according to intervention.	Nursing + Anaesthesiologist + Surgeon
	<b>Immediate postoperative procedure</b> Active maintenance of temperature Maintenance of FiO <sub>2</sub> 0.5w hours after operation ends. Prescribed analgesics according to operation. Minimal administration of morphics Restrictive fluid therapy Start of oral tolerance, 6 hours after surgery Start of mobilisation 8 hours after surgery Prophylaxis of thromboembolism with enoxaparin 40mg 10 pm.	Nursing + Anaesthesiologist

TIME	PROTOCOL	RESPONSIBILITY
<b>1<sup>st</sup> postoperative day</b>	Nutritional supplements in selected cases Normal diet according to tolerance Consider removing drainage, if any Active mobilisation (bed/chair/start to walk) Intravenous analgesia. No morphics If oral tolerance is correct, remove intravenous liquids Consider removing bladder catheterisation, if any	Nursing + Surgeon
<b>2<sup>nd</sup> postoperative day</b>	Consider removing bladder catheterisation (if it exists) Normal diet Active mobilisation (walking) Removal of intravenous liquids Prophylaxis of thromboembolism Consider discharge to home.	Nursing + Surgeon
<b>During remaining hospitalisation</b>	Normal diet Oral analgesia Active mobilisation (walking) Prophylaxis of thromboembolism Consider discharge to home.	Nursing + Surgeon
<b>On discharge</b>	Maintenance of thromboprophylaxis 28 days after surgery Telephone control after discharge General discharge criteria: No surgical complications, no fever, pain controlled with oral analgesia, complete deambulation, acceptance by patient Monitoring after discharge/care continuity Home support-Coordination with Primary Care	Nursing + Surgeon + PCP



## Overview

Note.- ITC: Inter-consultation



# Recommendations and Source of evidence

## I. PREOPERATIVE OPTIMISATION

The pre-anaesthesia and the preoperative assessment are the starting point of the clinical process and they permit informing and optimising the patient. This assessment should be carried out around four weeks prior to surgery. However, due to the urgency of the neoplastic process, this is not always possible.

The key elements of the assessment are:

- Complete preoperative review as soon as the need for surgery is known.
- The patient must have all the necessary information about the process to actively participate.
- The anaesthesiologist coordinates the process and refers to other specialists if necessary for correct optimisation.
- This is when the possible admissions dates are determined as well as the estimated stay if there are no complications.

## INFORMATION FOR THE PATIENT

The information for the patient is a key point in the surgical process. The patient must know about the treatment options and have realistic expectations about the risks and benefits expected. In this way, the aim is to achieve maximum collaboration and engagement from the patient in his/her treatment process<sup>18-20</sup>.

The participation of the nursing staff involved in the postoperative procedure is also essential in this phase, in addition to the surgery team. The information must be given verbally and in writing.

The information must be personalised, adapting it to the characteristics of each patient (ability to understand, cultural level, etc.). It is a known fact that a lot of the verbal information given to patients during the preoperative procedure is forgotten, and sometimes patients remember less than 25% of the information provided, especially when related to pre-surgical medication<sup>21-23</sup>.

The use of explanatory leaflets is very useful to find maximum collaboration in enhanced rehabilitation protocols. Information has proved to improve patients' satisfaction, it decreases anxiety as well as postoperative pain. These leaflets must include the main postoperative rehabilitation points,

the benefits obtained and how to obtain them, especially in terms of mobilisation, diet and breathing exercises. If a stoma is going to be carried out, a visit to a specialised consultation prior to the operation improves results considerably<sup>24-28</sup>.

1. **Patients must receive complete oral and written information regarding what they are requested to do in order to improve recovery after surgery.**

**Strong recommendation +. Moderate Level of Evidence.**

- Maessen J, Dejong CH, Hausel J, et al. A protocol is not enough to implement an enhanced recovery programme for colorectal resection. *Br J Surg* 2007;94:224-31<sup>29</sup>.

(Other relevant studies<sup>30</sup>).

## EVALUATION OF THE ANAESTHETIC-SURGICAL RISK

Elderly patients with co-existing diseases who are going to undergo a major surgery procedure have a higher surgical risk. The postoperative mortality of these patients is 5-25% and they must be identified in the preoperative stage and treated optimally prior to surgery. Thus, the anaesthetic risk (via ASA scale), the cardiological, surgical and nutritional risks must be assessed, and emphasis must be placed on changing harmful habits<sup>31,32</sup>.

An informed and optimised patient for surgery has faster recovery.

### ASSESSMENT OF THE CARDIOLOGICAL RISK

According to the Clinical Practice Guideline of the AHA (American Heart Association), the groups of patients with active cardiological disease must be assessed and treated by cardiologists prior to the surgical operation:

- **Unstable coronary syndrome:** Recent myocardial infarction or unstable angina.
- **Decompensated cardiac insufficiency:** Patients with NYHA functional class IV or new onset cardiac insufficiency.
- **Significant arrhythmia:** Mobitz II or third degree atrioventricular block. Ventricular or supraventricular arrhythmias (including atrial fibrillation) with uncontrolled ventricular response (heart rate of over 100 beats/minute) Symptomatic bradycardia.
- **Severe valvular disease:** Severe aortic stenosis, severe mitral stenosis.

2. **Patients with new onset or decompensated active cardiac pathology must be assessed by cardiologists prior to the operation.**

**Strong recommendation +. High Level of Evidence.**

- Fleisher LA, Beckman JA, Brown KA, Calkins H, Chaikof E, Fleischmann KE, et al. ACC/ AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery): Developed in Collaboration With the American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, and Society for Vascular Surgery. *Circulation*. 2007;116(17):1971-96<sup>34</sup>.

## ASSESSMENT OF NUTRITIONAL STATUS

Preoperative malnutrition is a factor that is known to have bad perioperative results, as it increases mortality and morbidity as well as the hospital stay<sup>35</sup>. Surgery represents an aggression for the organism that increases the requirements for macro and micronutrients. Furthermore, patients' diets are compromised by a variable time period following surgery, which may put their nutritional status at risk. It is thus advisable to carry out nutritional screening to identify undernourished patients or those at risk of malnutrition<sup>36</sup>. This screening should be done prior to the operation in all patients with programmed major surgery and during the hospital stay in cases of non-programmed surgery. The European and American international nutrition societies (ESPEN and ASPEN), recommend using nutritional screening tools that evaluate all or some of the following clinical aspects of the patient: body mass index, unintentional recent weight loss, knowledge of recent food intake, and in the case of hospitalised patients, the severity of the disease due to the increase of the requirements.<sup>37,38</sup> The nutritional screening tools must be valid, reliable, reproducible, simple to administer and be linked to an action protocol. Some of the screening tools that satisfy these requirements are the Nutrition Risk Screening (NRS-2002), Malnutrition Universal Screening Tool (MUST), Mini Nutritional Assessment (MNA), Malnutrition Screening Tool (MST), Short Nutrition Assessment Questionnaire (SNAQ), Nutrition Risk Index (NRI) and the *Valoración Subjetiva Global* (VSG)<sup>38,39</sup>.

A complete nutritional assessment must be carried out on undernourished patients or those that are at risk of malnutrition, who have been identified in the nutritional screening, in order to confirm the diagnosis, type and severity of the malnutrition and carry out adequate nutritional treatment (See figure 1: *Nutritional assessment algorithm*). The nutritional evaluation will include information about the consumption of food, weight loss or gain, body mass index, state of muscle mass and of subcutaneous fatty tissue, functional capacity, etc.<sup>40</sup>.

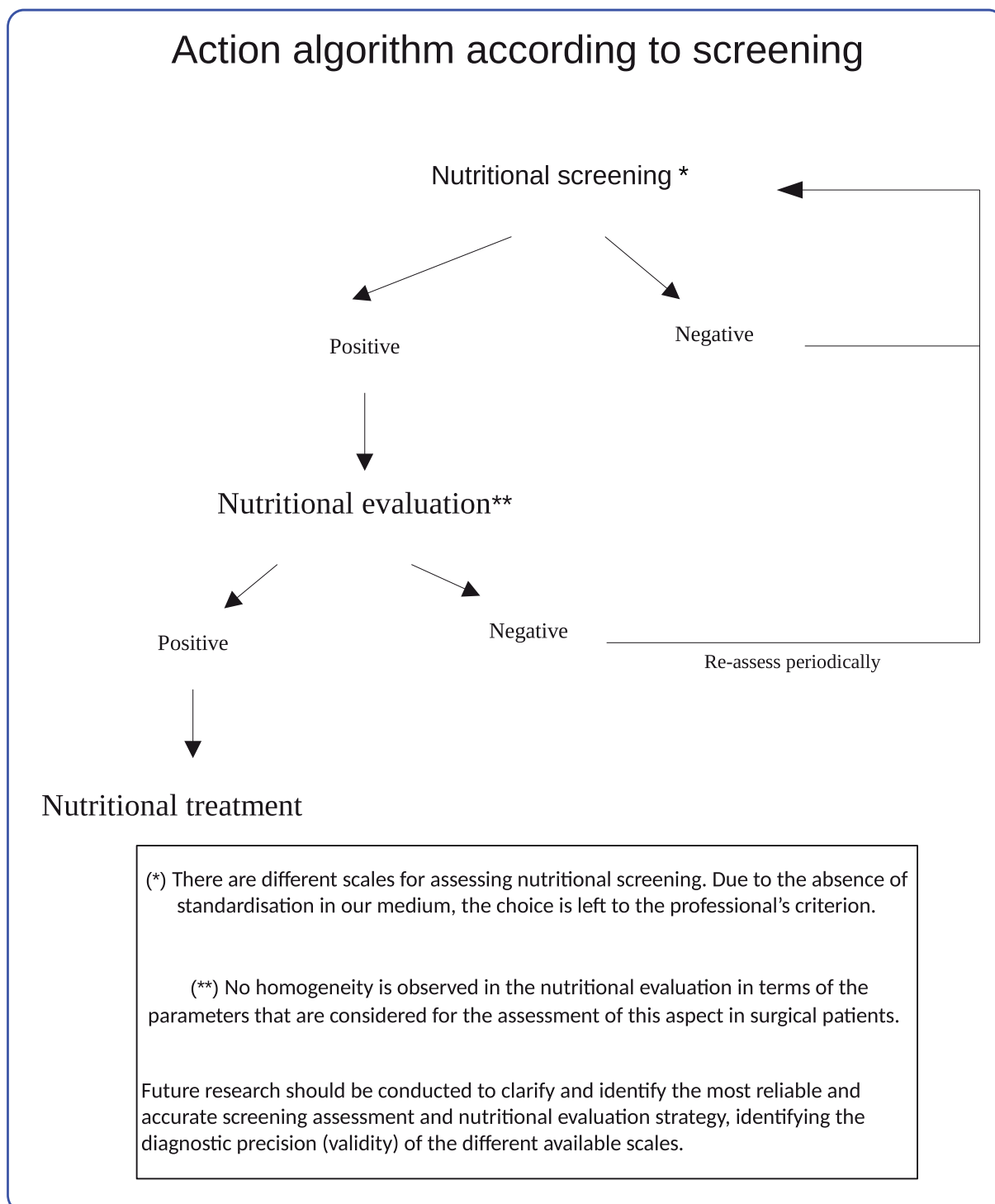
The current definition of malnutrition identifies three syndromes, according to the patient's inflammatory state, such as fasting without inflammatory process, malnutrition associated with a disease that is accompanied by acute inflammation, and malnutrition associated with disease and chronic inflammation<sup>41</sup>. Laboratory determinations can indicate the systemic degree of inflammation, for example, the measurement of serum albumin or of C-Reactive Protein<sup>40</sup>. Determinations of micronutrients can also be carried out, objectifying the functional capacity with dynamometry or spyrometry, and analysing the composition of lean mass and fat-free mass by means of bioimpedance analysis or DXA.

It is important to bear in mind that the laboratory determinations reflect a complex clinical situation that are not nutritional status specific. For example, although albumin is a predictive factor of mortality and of postoperative complications, it is of no use to determine the nutritional status, as its plasmatic levels are disturbed in a reverse manner to the patient's degree of inflammation, and they are modified with the state of hydration, as well as with the presence of hepatopathy and nephritic syndrome<sup>42,43</sup>.

Furthermore, albumin is not foreseeably modified with weight loss, fasting or nitrogenised balance in patients with different types of malnutrition, and it does not respond, either, to nutritional treatments within an inflammatory response<sup>44</sup>. Other laboratory determinations also present similar characteristics. Consequently, it is essential to frame the results of biochemical determinations within the patient's clinical context.

Figure 1.

## Nutritional assessment algorithm



### 3. Carrying out nutritional screening on all patients who are going to undergo major surgery is recommended

#### Strong recommendation +. Moderate Level of Evidence.

- Jensen GL, Compher C, Sullivan DH, Mullin GE. Recognizing malnutrition in adults: definitions and characteristics, screening, assessment, and team approach. JPEN J Parenter Enteral Nutr 2013;37:802-7<sup>39</sup> (other documents of interest<sup>40,41</sup>).

### 4. When a patient at risk of malnutrition is identified, a complete nutritional evaluation must be carried out, establishing a nutritional treatment plan, monitoring tolerance and response to this plan. Some laboratory determinations may inform of the degree of inflammation associated with the disease (albumin, C-Reactive protein, etc.) and of possible nutrient deficiencies (vitamins, minerals), permitting a better syndrome classification of the patient's malnutrition.

#### Strong recommendation +. Moderate Level of Evidence.

- Khuri SF, Daley J, Henderson N, Hur K, Gibbs JO, Barbour G, et al. Risk adjustment of the postoperative mortality rate for the comparative assessment of the quality of surgical care: results of the National Veterans Surgical Risk Study. J Am Coll Surg 1997;185:315-27<sup>42</sup>.  
(other documents of interest<sup>43,44</sup>).

## ASSESSMENT OF DIABETES MELLITUS

There is sufficient evidence to show that perioperative hyperglycaemia worsens the prognosis of patients undergoing surgery, and it is an independent risk factor for postoperative mortality and infections, regardless of the status of the diabetes, so:

### 5. The control of hyperglycaemia is essential and it must be performed by an Endocrinology service in case of bad glycaemia control and by Primary Care.

#### Weak recommendation+. Moderate Level of Evidence.

- Doenst T, Wijesundera D, Karkouti K, et al. Hyperglycaemia during cardiopulmonary bypass is an independent risk factor for mortality in patients undergoing cardiac surgery. J Thorac Cardiovasc Surg. 2005;130:1144<sup>45</sup>.

It is important to detect diabetes in patients undergoing surgery, as uncontrolled postoperative hyperglycaemia increases complications. Everything possible will be done for known diabetic patients to be well controlled prior to surgery. An attempt will be made to optimise the situation of patients who are detected to have hyperglycaemia and who have no prior diagnosis before surgery by means of assessment by endocrinologists.

It has been seen that an increase of Haemoglobin A1c may predict postoperative hyperglycaemia and complications after colorectal surgery.

### 6. Preoperative procedure determination of HbA1c is suggested.

#### Weak recommendation+. Low Level of evidence

- Gustafsson UO, Thorell A, Soop M, Ljungqvist O, Nygren J. Haemoglobin A1c as a predictor of postoperative hyperglycaemia and complications after major colorectal surgery. Br J Surg. 2009;96:1358-64<sup>46</sup>.

## ASSESSMENT OF PREOPERATIVE ANAEMIA

Preoperative anaemia is a frequent finding, its presence is the determining factor for allogeneic blood transfusion, mainly due to an iron deficiency, which includes absolute iron deficiency (there are no reserves), functional iron deficiency (situation where the demand of iron exceeds the deposit) and iron sequestration<sup>47-49</sup>.

The preoperative assessment of the iron status is essential for adequate treatment. Preoperative haemoglobin (Hb) must be determined sufficiently in advance to be able to treat the anaemia. Treatment with oral iron is useful, providing there is sufficient time for it to be effective. In those cases where there is not sufficient time, intravenous treatment with iron is safe, providing a greater and faster increase of Hb, which may give rise to reducing the need for an allogeneic blood transfusion (ABT)<sup>50-59</sup>.

In anaemia derived from the existence of uterine fibroids, gonadotropin releasing hormone agonists (GnRHa) have proved to be useful, inducing a state of hypostrogenism as potential treatment. Treatment with GnRHa causes a reduction in fibromas, but they cannot be used in the long term due to side effects and bone loss. Consequently, GnRHa can be used in the preoperative period both for reducing the fibroma and the uterine volume and to control the haemorrhage. Although some of these tumours are asymptomatic, up to 50% cause sufficiently severe symptoms as to require treatment.

Ulipristal acetate, a selective modulator of progesterone receptors, is currently being used. It has less side effects than similar ones, but there is insufficient scientific evidence to date.

### 7. Detecting preoperative anaemia is recommended, as it is associated with an increase of perioperative mortality.

#### Strong recommendation +. High Level of Evidence.

- S. Sabaté, A. Mases, N. Guilera et al. Incidence and predictors of major perioperative adverse cardiac and cerebrovascular events in non-cardiac surgery. *Br J Anaesth*, 2011;107: 879-90<sup>60</sup> (other related studies of interest<sup>61-66</sup>).

### 8. Determining Hb in patients undergoing elective surgery is recommended at least 28 days prior to surgery, as this gives sufficient time for erythropoiesis stimulation, if necessary.

#### Strong recommendation +. Moderate Level of Evidence.

- Goodnough LT, Maniatis A, Earnshaw P, Benoni G, Beris P, Bisbe E, et al. Detection, evaluation, and management of preoperative anaemia in the elective orthopaedic surgical patient: NATA guidelines. *Br J Anaesth*. 2011;106(1):13–22<sup>67</sup>.
- Goodnough LT, Shander A, Spivak JL, Waters JH, Friedman AJ, Carson JL, et al. Detection, evaluation, and management of anemia in the elective surgical patient. *Anesthesia & Analgesia*. 2005;101(6):1858–61<sup>68</sup>.
- Beris P, Muñoz M, García-Erce JA, Thomas D, Maniatis A, Van der Linden P. Perioperative anaemia management: consensus statement on the role of intravenous iron. *Br J Anaesth*. 2008;100:599–604<sup>69</sup>.



9. It is suggested that the level of preoperative Hb prior to surgery should be within the normality margins identified by the WHO (men Hb  $\geq 13\text{g/dl}$ ; women  $\geq 12\text{g/dl}$ ).

**Weak recommendation+. Moderate Level of Evidence.**

- Goodnough LT, Shander A, Spivak JL, Waters JH, Friedman AJ, Carson JL, et al. Detection, evaluation, and management of anemia in the elective surgical patient. *Anesthesia & Analgesia*. 2005;101(6):1858–61<sup>68</sup>.

10. Treatment with oral iron is suggested in anaemic patients, for 14 days prior to surgery with 200 mg/day of ferric sulphate; to increase preoperative Hb and decrease ABT in patients with colorectal cancer.

**Strong recommendation +. Moderate Level of Evidence.**

- Okuyama M, Ikeda K, Shibata T, Tsukahara Y, Kitada M, Shimano T. Preoperative iron supplementation and intraoperative transfusion during colorectal cancer surgery. *Surg Today*. 2005;35:36–40<sup>70</sup>.
- Lidder PG, Sanders G, Whitehead E, Douie WJ, Mellor N, Lewis SJ, Hosie KB. Preoperative procedure oral iron supplementation reduces blood transfusion in colorectal surgery -a prospective, randomised, controlled trial. *Ann R Coll Surg Engl*. 2007;89:418-21<sup>71</sup>.

11. Treatment with intravenous iron is suggested in anaemic patients who are going to require gynaecological and colorectal surgery to increase preoperative Hb and reduce ABT.

**Strong recommendation +. Moderate Level of Evidence.**

- Beris P, Muñoz M, García-Erce JA, Thomas D, Maniatis A, Van der Linden P. Perioperative anaemia management: consensus statement on the role of intravenous iron. *Br J Anaesth*. 2008;100:599–604<sup>69</sup>.

12. The use of intravenous iron, instead of oral iron, is suggested in those cases where the latter is contraindicated or there is insufficient time.

**Strong recommendation +. Moderate Level of Evidence.**

- Auerbach M, Ballard H. Clinical use of intravenous iron: administration, efficacy, and safety. *Hematology Am Soc Hematol Educ Program*. 2010;2010:338-47<sup>72</sup>.
- Edwards TJ, Noble EJ, Durran A, Mellor N, Hosie KB. Randomized clinical trial of preoperative IV iron sucrose to reduce blood transfusion in anaemic patients after colorectal cancer surgery. *Br J Surg* 2009;96:1122–8<sup>73</sup>.

13. The use of gonadotropin-releasing hormone agonists (GnRHa) is suggested for the preoperative treatment of haemorrhage-derived anaemia faced with the existence of uterine fibroids.

**Strong recommendation +. High Level of Evidence.**

- Preoperative procedure GnRH analogue therapy before hysterectomy or myomectomy for uterine fibroids. Anne Lethaby, Beverley Vollenhoven, Martin C Sowter. Editorial Group: Cochrane Menstrual Disorders and Subfertility Group Published Online: 23 APR 2001. Assessed as up-to-date: 9 JAN 2001. DOI: 10.1002/14651858.CD000547. Copyright © 2011. The Cochrane Collaboration. Published by John Wiley & Sons, Ltd<sup>74</sup>.

(Other studies of interest on these recommendations<sup>75-82</sup>).

### IDENTIFICATION OF PATIENTS WHO REQUIRE SPECIALISED CARE

#### High Cardiovascular Risk

Unstable coronary syndrome: Unstable angina or recent myocardial infarction. Decompensated heart failure: Patients with NYHA functional class IV or new onset cardiac insufficiency. Mobitz II or third degree atrioventricular block. Ventricular or supraventricular arrhythmias (including atrial fibrillation) with uncontrolled ventricular response (heart rate of over 100 beats/minute) Symptomatic bradycardia. Severe valvular disease: Severe aortic stenosis, severe mitral stenosis.

#### High Nutritional Risk

Complete nutritional evaluation

#### High Hb transfusion risk 6-10g/dl

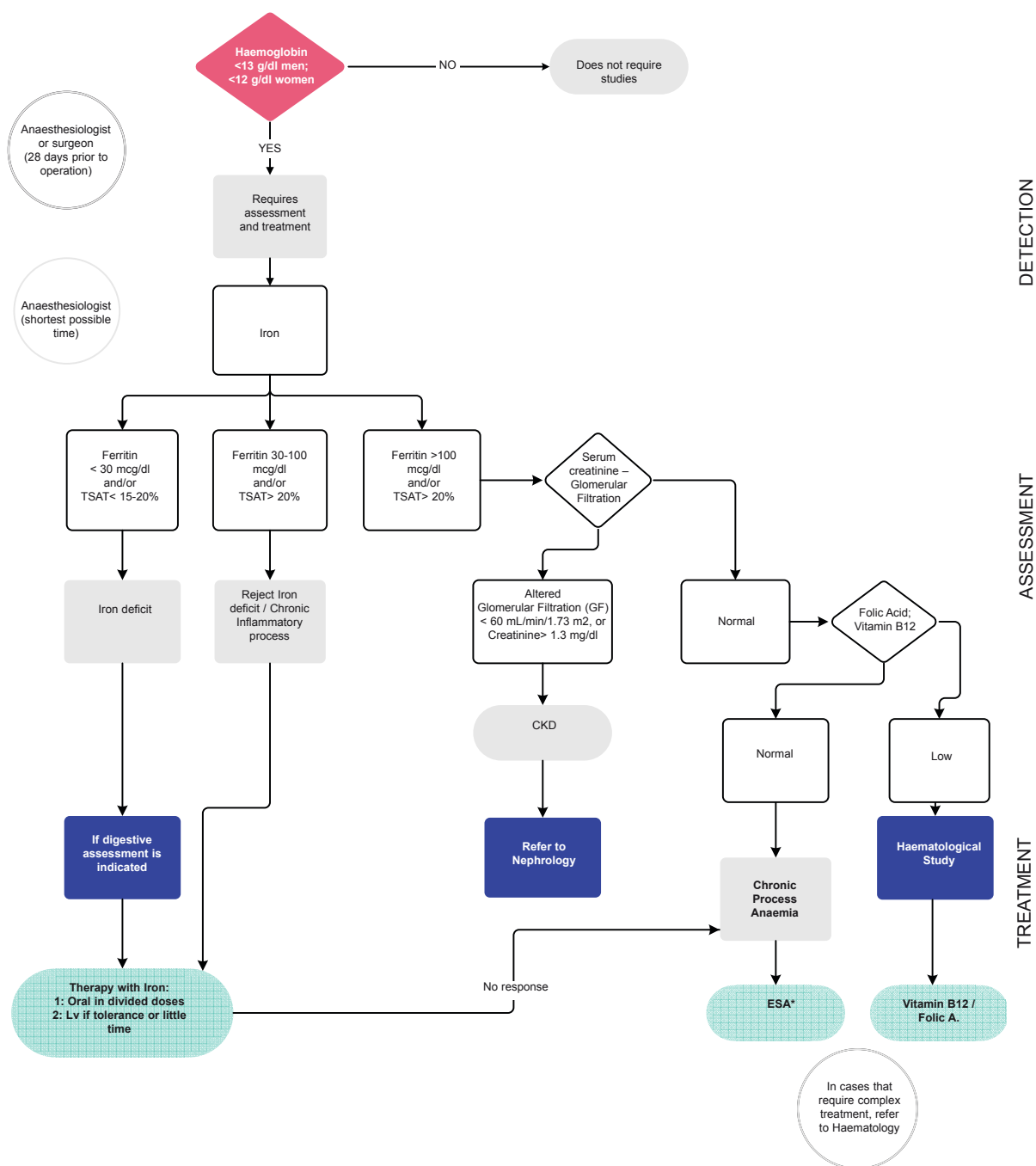
Patients with HBP or badly controlled DM require optimisation in primary care

**Identification of risk patients**



Figure 2.

## Algorithm for preoperative management of anaemic patients



Assessment and treatment: responsibility of anaesthesiologist in shortest time possible, unless referred to haematologist.

CKD = Chronic Kidney Deficiency

Altered Glomerular Filtration – Serum Creatinine: (GF) < 60 mL/min/1.73 m2 or Creatinine > 1.3 mg/dL.

TSAT = Transferrin Saturation.

ESA = erythropoiesis-stimulating-agents

## PREOPERATIVE FASTING AND TREATMENT WITH CARBOHYDRATE DRINKS

### FASTING

Resistance to postoperative insulin is a metabolic response to surgical harm. Traditional preoperative fasting may worsen this resistance and raise glycaemia. Fasting may also cause variable degrees of dehydration, increasing the prevalence of nausea and vomiting, above all, in outpatient surgery.

The use of carbohydrate-rich drinks is safe up to two hours before elective surgery. Evidence is derived from studies performed with specifically developed products for perioperative use, mainly maltodextrins. Not all carbohydrates are necessarily safe.

The administration of oral maltodextrins up to two hours before anaesthetic induction does not increase gastric residual volume and is not associated with any risk. Moreover, its administration the night before and the morning of surgery decreases resistance to insulin. This effect is possibly very beneficial, as a causal relationship has been suggested between resistance to postoperative insulin and post-surgical complications. Furthermore, they improve subjective well-being and reduce thirst and hunger. The postoperative immunity function also improves with the administration of oral carbohydrates.

Other new formulas of preoperative drinks have been studied. The administration of glutamine and carbohydrates is safe and does not increase the gastric volume. It decreases postoperative inflammatory response and improves insulin resistance.

By way of conclusion, we can state that the preoperative administration of carbohydrate-enriched drinks the night before and up to two hours before surgery is totally safe, it improves the feeling of well-being and has beneficial effects that could decrease postoperative complications. Adding glutamine to solutions seems to be even more beneficial although more studies are required to determine its effect on the metabolic response and sensitivity to insulin after surgery.

#### 14. Fasting will be limited to 6 hours for solids and 2 hours for liquids, even for obese and diabetic patients as it has been amply demonstrated that fasting of more than eight hours does not provide any benefit.

##### **Strong recommendation +. High Level of Evidence.**

- \* Brady M., Kinn S., Stuart P. Preoperative fasting for adults to prevent perioperative complications. Cochrane Database Syst Rev 2003;CD004423<sup>83</sup>.
- \*\* Smith I, Kranke P, Murat I, et al. Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology. Eur J Anaesthesiol 2011;28(8):556-69<sup>84</sup>.
- Wang Q, Wang WJ, et al. Randomized clinical trial to compare the effects of preoperative oral carbohydrate versus placebo on insulin resistance after colorectal surgery. Br J Surg 2010;97(3):317-27<sup>85</sup>.
- \* Brady M, Kinn S, Ness V, O'Rourke K, Randhawa N, Stuart P. Preoperative fasting for preventing perioperative complications in children. Cochrane Database Syst Rev. 2009 Oct 7;(4):CD005285<sup>86</sup>.
- Kaska M, Grosmanová T, Havel E, Hyspler R, Petrová Z, Brtko M, Bares P, Bares D, Schusterová B, Pyszková L, Tosnerová V, Sluka M. The impact and safety of preoperative oral or intravenous carbohydrate administration versus fasting in colorectal surgery-a randomized controlled trial. Wien KlinWochenschr. 2010 Jan;122(1-2):23-30<sup>87</sup>.

- \* Mathur S, Plank LD, McCall JL, Shapkov P, McIlroy K, Gillanders LK, Merrie AE, Torrie JJ, Pugh F, Koea JB, Bissett IP, Parry BR. Randomized controlled trial of preoperative oral carbohydrate treatment in major abdominal surgery. *Br J Surg*. 2010 Apr;97(4):485-94<sup>88</sup>.
- \*\* Smith I, Kranke P, Murat I, Smith A, O'Sullivan G, Søreide E, Spies C, in't Veld B; European Society of Anaesthesiology. Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology. *Eur J Anaesthesiol*. 2011 Aug;28(8):556-69<sup>89</sup>.
- Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures: An Updated Report by the American Society of Anesthesiologists Committee on Standards and Practice Parameters. *Anesthesiology*. 2011;114 (3):495-511<sup>90</sup>.

## CARBOHYDRATE DRINKS

15. The regular administration of carbohydrate drinks (200-300 cc) with 12.5% maltodextrins is recommended two hours before surgery, as this reduces anxiety and insulin resistance. As well as losses of nitrogen and muscle mass, permitting a faster recovery with reduction of hospital stay.

### Strong recommendation +. High Level of Evidence.

- Svanfeldt M, Thorell A, Hausel J, Soop M, Rooyackers O, Nygren J et al (2007). Randomized clinical trial of the effect of preoperative oral carbohydrate treatment on postoperative whole-body protein and glucose kinetics. *Br J Surg* 94(11):1342–50<sup>91</sup>.
- Yuill KA, Richardson RA, Davidson HI, Garden OJ, Parks RW (2005). The administration of an oral carbohydrate-containing fluid prior to major elective upper-gastrointestinal surgery preserves skeletal muscle mass postoperatively—a randomised clinical trial. *Clin Nutr* 24(1):32–7<sup>92</sup>.
- \* Noblett SE, Watson DS, Huong H, Davison B, Hainsworth PJ, Horgan AF. Preoperative procedure oral carbohydrate loading in colorectal surgery: a randomized controlled trial. *ColorectalDis*. 2006;8(7):563-9<sup>93</sup>.
- Smith I, Kranke P, Murat I, Smith A, O'Sullivan G, Søreide E et al. Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology. *Eur J Anaesthesiol*. 2011;28(8):556-69<sup>94</sup>.
- Gustafsson UO, Scott MJ, Schwenk W, Demartines N, Roulin D, Francis N, et al. Guidelines for perioperative care in elective colonic surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. *World J Surg*. 2013;37(2):259-84.<sup>95</sup>.

16. Measures will be taken in patients with prolonged gastric clearance in order to prevent regurgitation during anaesthetic induction.

### Strong recommendation +. High Level of Evidence.

- \* Brady M, Kinn S, Stuart P (2003) Preoperative fasting for adults to prevent perioperative complications. *Cochrane Database Syst Rev* 4:CD004423<sup>96</sup>.
- \*\* Smith I, Kranke P, Murat I, Smith A, O'Sullivan G, Søreide E et al (2011) Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology. *Eur J Anaesthesiol* 28(8):556–69<sup>97</sup>.

- Maltby JR, Pytko S, Watson NC, Cowan RA, Fick GH (2004). Drinking 300 mL of clear fluid two hours before surgery has no effect on gastric fluid volume and pH in fasting and non-fasting obese patients. *Can J Anaesth* 51(2):111–5<sup>98</sup>.

**17. Offering a carbohydrate drink to type 2 diabetes patients may be considered before surgery. This can be administered together with their antidiabetes medication.**

**Weak recommendation+. Low Level of evidence**

- \*\* Smith I, Kranke P, Murat I, Smith A, O’Sullivan G, Soreide E et al. Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology. *Eur J Anaesthesiol*. 2011;28(8):556-69<sup>98</sup>.
- \* Gustafsson UO, Nygren J, Thorell A, Soop M, Hellström PM, Ljungqvist O, HagströmToft E. Preoperative procedure carbohydrate loading may be used in type 2 diabetes patients. *Acta Anaesthesiol Scand*. 2008;52(7):946-51<sup>99</sup>.

(other studies of interest on this topic<sup>100</sup>)

## RECOMMENDATIONS FOR THE PATIENT

### Tobacco and Alcohol

The number of alcohol and drug addicts continues to increase in European countries, and it is believed that around 15% of the population are daily users, 9% with harmful patterns and around 5% are estimated to be addicts in agreement with the Directorate General of the European Commission on Health and Food Safety. Disorders due to the intake of alcohol have a negative influence on postoperative results, such as higher surgical wound infection rates, abstinence syndrome or organic dysfunctions.

**18. In general, compulsory smoking cessation one month prior to the operation is accepted, as its consumption increases the risk of pulmonary complications by up to 50%; as well as the consumption of alcohol, related to postoperative complications and intraoperative bleeding.**

**Strong recommendation +. High Level of Evidence.**

- Sørensen LT, Karlsmark T, Gottrup F. Abstinence from smoking reduces incisional wound infection: a randomized controlled trial. *Ann Surg* 2003;238(1):1e5.s<sup>101</sup>.
- Sørensen LT. Wound healing and infection in surgery. The clinical impact of smoking and smoking cessation: a systematic review and meta-analysis. *Arch Surg*. 2012;147(4):373-83<sup>102</sup>.
- Wong J, Lam DP, Abrishami A, Chan MT, Chung F. Short-term preoperative smoking cessation and postoperative complications: a systematic review and meta-analysis. *Can J Anaesth*. 2012;59(3):268-79<sup>103</sup>.
- Myers K, Hajek P, Hinds C, McRobbie H. Stopping smoking shortly before surgery and postoperative complications: a systematic review and meta-analysis. *Arch Intern Med*. 2011;171(11):983-9<sup>104</sup>.

(other studies of interest on this topic<sup>105</sup>)

## “Prehabilitation”

This term is used to define rehabilitation prior to surgery. Despite the few studies found in literature and the obvious need for more studies on “prehabilitation”, some conclusions can be obtained. “Prehabilitation” programmes seem to maintain and improve patients’ functional capacity. No unified criteria exist on what the “prehabilitation” therapy must be like; however, trimodal therapy improves the mentioned results. There is no unanimous criterion, either, about the exercise programme that must be prescribed, although this must be easy to comply with by the patient.

### 19. Doing preoperative prehabilitation exercises is suggested in order to improve functional capacity.

#### **Weak recommendation+. Moderate Level of Evidence.**

- Carli F, Charlebois P, Stein B, Feldman L, Zavorsky G, Kim DJ, et al. Randomized clinical trial of prehabilitation in colorectal surgery. Br J Surg. 2010;97(8):1187-97<sup>106</sup>.
- Hulzebos EH, Helders PJ, Favie NJ, De Bie RA, Brutel de la Riviere A, Van Meeteren NL. Preoperative intensive inspiratory muscle training to prevent postoperative pulmonary complications in high-risk patients undergoing CABG surgery: a randomized clinical trial. JAMA 2006;296(15):1851-7<sup>107</sup>.

(Other studies of interest on this topic<sup>108-111</sup>).

### PATIENT IN THE BEST PREOPERATIVE CONDITIONS



### *Multi-disciplinary Health Care*

#### Hygiene and preparation of the skin for surgery

Bathing the night prior to surgery has proved to be effective in preventing surgical site infection.

#### Bathing

The importance of bathing or showering the night before surgery is unquestionable, as is the reduction of the number of bacterial colonies due to bathing.

## 20. Having a full bath prior to surgery is recommended.

### **Strong recommendation +. High Level of Evidence.**

- Webster J, Osborne S. Preoperative bathing or showering with skin antiseptics to prevent surgical site infection. Cochrane Database of Systematic Reviews 2012, Issue 9. Art. No.: CD004985<sup>112</sup>.

(Other studies of interest on this topic<sup>113,114</sup>)

## HAIR REMOVAL

Whenever hair removal is necessary, electric shavers must be used to clip the hair instead of traditional shaving. This prevents skin abrasions and the possibility of subsequent bacterial growth and colonisation.

## 21. Whenever hair removal is necessary, the use of electric shavers is recommended.

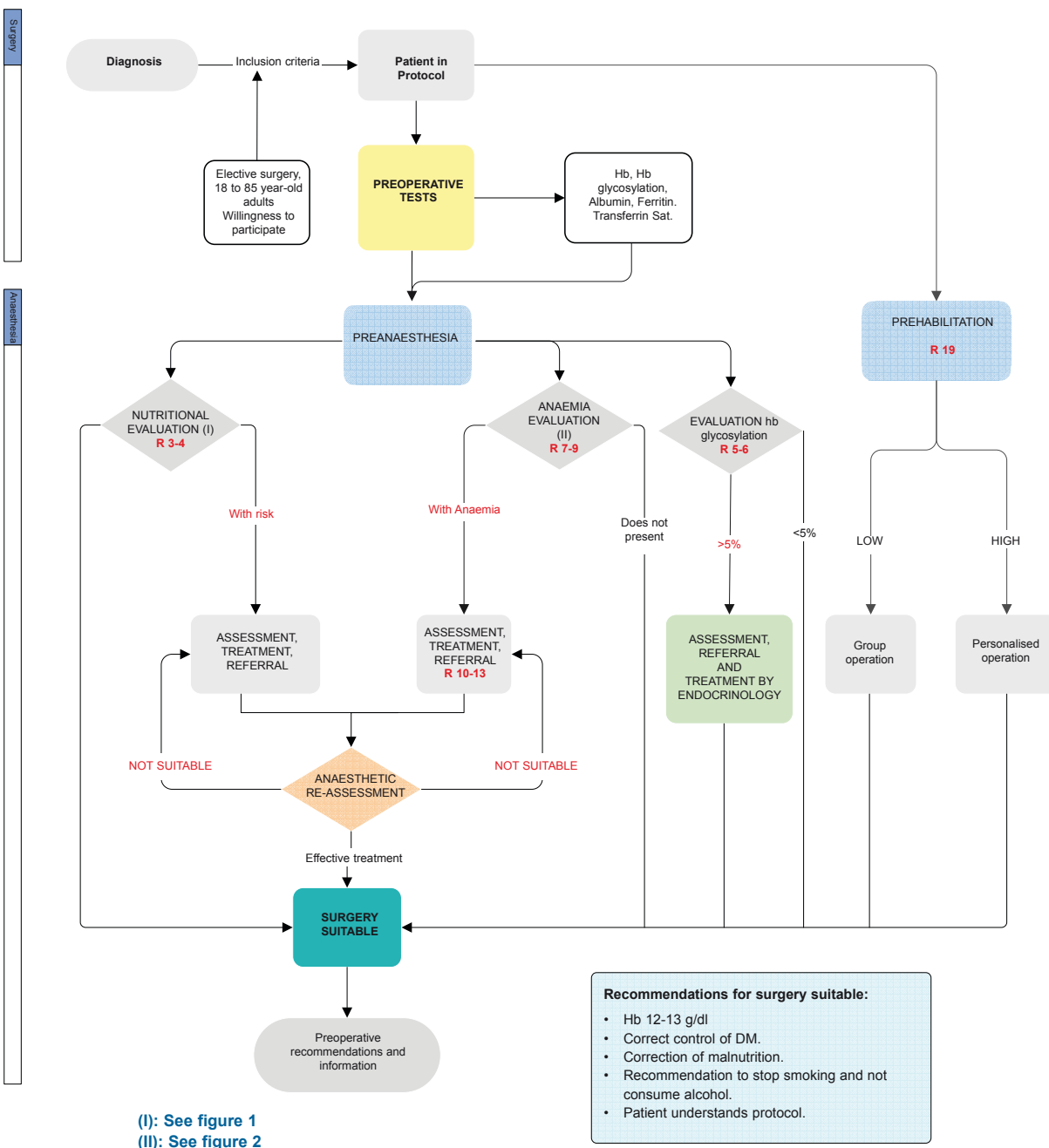
### **Strong recommendation +. Moderate Level of Evidence.**

- Tanner J, Norrie P, Melen K. Preoperative hair removal to reduce surgical site infection. Cochrane Database of Systematic Reviews 2011, Issue 11. Art. N°: CD004122<sup>115</sup>.
- Jose B, Dignon A. Is there a relationship between preoperative shaving (hair removal) and surgical site infection? J Perioper Pract. 2013;23 (1-2):22-5<sup>116</sup>.

# OVERVIEW OF PREOPERATIVE CARE

Figure 3.

## Preoperative management algorithm



Following surgery consultation, the anaesthesiologist carries out the first evaluation and re-assessment at 28 and 14 preoperative days, respectively.



## II. IMMEDIATE PREOPERATIVE PROCEDURE

### BOWEL PREPARATION

It has been historically considered that mechanical bowel preparations reduced the prevalence of surgical wound infection, as they reduced the bacterial load. It was also considered that the prevalence of ischaemia in new anastomosis would be reduced when intraluminal pressure was decreased. Different studies indicate that MBP does not provide any benefit, it increases the risk of complications such as postoperative ileus and anastomotic suture dehiscence, and it alters hydro-electrolytical equilibrium, meaning that elderly or neoplastic patients do not arrive at surgery in optimal conditions.

#### 22. The current recommendation with respect to mechanical bowel preparation is not to perform it, with the exception of rectal surgery cases where there are possibilities of protection stoma.

##### **Strong recommendation –. High Level of Evidence.**

- Pineda CE, Shelton AA, Hernandez-Broussard et al. Mechanical bowel preparation in intestinal surgery: a meta-analysis and review of the literature. *J Gastrointest Surg.* 2008;12:2037-44<sup>117</sup>.
- Gravante G, Caruso R, Andreani SM, et al. Mechanical bowel preparation for colorectal surgery: a meta-analysis on abdominal and systemic complications on almost 5000 patients. *Int J Colorectal Dis* 2008;23:1145-50<sup>118</sup>.
- Slim K, Vicaut E, Launay-Savary MV, et al. Updated systematic review and meta-analysis of randomized clinical trials on the role of mechanical bowel preparation before colorectal surgery. *Ann Surg* 2009;249:203-9<sup>119</sup>.
- Guenaga KK, Matos D, Wille-Jorgensen P. Mechanical bowel preparation for elective colorectal surgery. *Cochrane Database Syst Rev* 2009;(1):CD001544<sup>120</sup>.
- Wille-Jørgensen P, Guenaga KF, Matos D, Castro AA. Preoperative mechanical bowel cleansing or not? an updated meta-analysis. *Colorectal Dis.* 2005 Jul;7(4):304-10<sup>121</sup>.
- Güenaga KF, et al. Mechanical bowel preparation for elective colorectal surgery. *Cochrane Database Syst Rev* 2011;(9):CD001544<sup>122</sup>.
- Bretagnol F, et al. Rectal cancer surgery with or without bowel preparation: The French GRECCAR III multicenter single-blinded randomized trial. *Ann Surg* 2010;252:863-8<sup>123</sup>.

#### 23. No bowel preparation could contribute to faster recovery from bowel peristalsis and a shorter hospital stay.

##### **Strong recommendation +. Moderate Level of Evidence.**

- Howard DD, White CQ, Harden TR et al. Incidence of surgical site infections postcolorectal resections without preoperative mechanical or antibiotic bowel preparation. *Am Surg* 2009;75(8):659-63<sup>124</sup>.

(Other studies of interest on this topic<sup>125-129</sup>)

### THROMBOPROPHYLAXIS

Thromboembolic disease is common following major surgery, and it is estimated in approximately 20% of patients undergoing general surgery and 30% undergoing colorectal surgery.



**24. Compression stockings are effective to prevent thromboembolic disease in surgical patients, further reducing the risk if combined with pharmacological agents.**

**Strong recommendation +. High Level of Evidence.**

- Agu O, Hamilton G, Baker D. Graduated compression stockings in the prevention of venous thromboembolism. *Br J Surg* 1999;86(8):992-1004<sup>130</sup>.

**25. Intermittent pneumatic compression devices decrease the prevalence of deep vein thrombosis and the combined method with pharmacological measures is more effective.**

**Strong recommendation +. High Level of Evidence.**

- Urbankova J, Quiroz R, Kucher N et al. Intermittent pneumatic compression and deep vein thrombosis prevention. *Thromb Haemost* 2005;94(6):1181-85<sup>131</sup>.
- Kakkos SK, Caprini JA, Geroulakos G et al. Combined intermittent pneumatic leg compression and pharmacological prophylaxis for prevention of venous thromboembolism in high-risk patients. *Cochrane Database Syst Rev* 2008;(4):CD005258<sup>132</sup>.
- Wille-Jorgensen P, Rasmussen MS, Andersen BR et al. Heparins and mechanical methods for thromboprophylaxis in colorectal surgery. *Cochrane Database Syst Rev* 2004;(1):CD001217<sup>133</sup>.

Pharmacological prophylaxis significantly reduces the prevalence of thromboembolic disease.

**26. Unfractionated heparin (UFH) and low molecular weight heparins (LMWH) are equally effective in preventing deep vein thrombosis and pulmonary thrombo-embolism.**

**Strong recommendation +. High Level of Evidence.**

- McLeod RS, Geerts WH, Sniderman KW, et al. Canadian Colorectal Surgery DVT Prophylaxis Trial Investigators. Subcutaneous heparin versus low-molecular-weight heparin as thromboprophylaxis in patients undergoing colorectal surgery: results of the Canadian colorectal DVT prophylaxis trial: a randomized, double blind trial. *Ann Surg* 2001;233(3):438-44<sup>134</sup>.
- Bergqvist D, et al; ENOXACAN Study Group. Efficacy and safety of enoxaparin versus unfractionated heparin for prevention of deep vein thrombosis in elective cancer surgery: a double-blind randomized multicentre trial with venographic assessment. *Br J Surg* 1997;84(8):1099-103<sup>135</sup>.
- Mismetti P, Laporte S, Darmon JY et al. Meta-analysis of low molecular weight heparin in the prevention of venous thromboembolism in general surgery. *Br J Surg* 2001;88(7):913-30<sup>136</sup>.

The administration of the type of heparin of choice, the dose and frequency (dose regimen), will be determined by the type of surgery, as well as by the prophylaxis protocols depending on the services involved. Dose adjustments according to renal function are not contemplated here, nor are pharmacological alternatives according to allergies or interactions, as this document is aimed at the National Health System and the responsibility to adapt these circumstances to the medium falls upon those who implement it.

(Other studies of interest on this topic<sup>137</sup>)

## ANTIBIOTIC PROPHYLAXIS

When indicated, the first dose must be administered one hour prior to the start of the surgical incision.

One single dose is as effective as multidose regimens, although if surgery lasts for more than 3 hours, or there are bleedings of more than 1500 cc, a booster must be administered.

The administration of the prophylactic antibiotic of choice, the dose and frequency (dose regimen), will be determined by the type of surgery (clean, clean-contaminated, contaminated and dirty surgery, as well as by the prophylaxis protocols depending on the services involved).

### 27. Routine prophylaxis with intravenous antibiotics is recommended between 30 and 60 minutes before surgical incision. Repeating the dose is advised in prolonged procedures in agreement with the average life of the drugs.

Strong recommendation +. High Level of Evidence.

- Nelson RL, Glenny AM, Song F. Antimicrobial prophylaxis for colorectal surgery. Cochrane Database Syst Rev 2009;(1). CD001181<sup>138</sup>.
- Steinberg JP, Braun BI, Hellinger WC, Kusek L, Bozikis MR, Bush AJ, et al. Timing of antimicrobial prophylaxis and the risk of surgical site infections: results from the Trial to Reduce Antimicrobial Prophylaxis Errors. Ann Surg 2009;250(1):10-6<sup>139</sup>.

(Other studies of interest on this topic<sup>140-143</sup>).

## MANAGING PREOPERATIVE ANXIETY

Anxiety is a common manifestation in surgical patients, mainly in the immediate preoperative stage, and it is in this phase when patients have a higher level of anxiety.

A direct relationship between preoperative anxiety and an increase of postoperative pain as well as with longer postoperative stay has been established.

The preoperative visit of the theatre nurses has proven to be useful in surgical patients, resulting in a decrease in the level of fear and anxiety, better self-control of the patient and knowledge about the care required by disease, improvement of the level of comfort and decrease of the level of pain. When exactly this visit should take place has been the reason for controversy, as visits made during the moments prior to surgery have been questioned.

### 28. The preoperative visit of theatre nurses is recommended to decrease anxiety.

**Strong recommendation +. Low Level of evidence**

- Forster AJ, Clark HD, Menard A, Dupuis N, Chernish R, Chandok N et al. Effect of a nurse team coordinator on outcomes for hospitalized medicine patients. Am J Med 2005; 118(10):1148–53<sup>19</sup>.
- Zenobia Chan, Carmen Kan, Patrick Lee, Isabel Chan and Joyce Lam. A systematic review of qualitative studies: patients' experiences of preoperative communication. Journal of Clinical Nursing 2011; 21:812–2420.
- Ronco M, Iona L, Fabbro C, Bulfone G, and Palese A. Patient education outcomes in surgery: a systematic review from 2004 to 2010. International Journal of Evidence-Based Healthcare. 2010;10(4):309-23<sup>21</sup>.

- Kruzik N. Benefits of preoperative education for adult elective surgery patients. AORN J. 2009;90(3):381-7<sup>23</sup>.

## PREMEDICATION

### Sedatives

The use of premedication with long-acting drugs such as opioids or benzodiazepines, prevents early recovery, causing a delay in the start of mobilisation and of oral tolerance to liquids, increasing the hospital stay.

**29. Short-acting anxiolytics may interfere in starting to recover mobility and the ability to intake food, although they do not affect the duration of the hospital stay, so they can be used to facilitate regional anaesthesia techniques when these are indicated.**

#### **Weak recommendation+. Low Level of evidence**

- Hannemann, P. Lassen, K. Hausel, J. Nimmo, S. Ljungqvist, O. Nygren, J. Soop, M. Fea-ron, K. Andersen, J. Revhaug, A. Von Meyenfeldt, M.F. Dejong, C.H.C. Spies, C. Patterns in current anaesthesiological perioperative procedure practice for colonic resections: a survey in five northern-European countries. Act Anaest Scand 2006;50(9):1399-1405<sup>144</sup>.
- Gustafsson UO, Scott MJ, Schwenk W, Demartines N, Roulin D, Francis N, et al. Guidelines for perioperative care in elective colonic surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. World J Surg. 2013;37(2):259-84<sup>145</sup>.
- Arrowsmith, JE. Premedication. Surgery 2005;23(12):440–1<sup>146</sup>.

### Glucocorticoids

The preoperative administration of glucocorticoids has been proposed to reduce postoperative morbidity as it produces an alleviation of post-surgical inflammatory response, as well as its manifestations due to reduction of concentration, distribution and function of peripheral leukocytes, and of prostaglandin synthesis. Furthermore, they cause vasoconstriction of vessels, decreasing capillary permeability and inhibiting the activity of kinins and bacterial endotoxins, at the same time as they reduce the quantity of histamine released by the basophiles.

**30. The administration of one single dose of glucocorticoids may have a significant impact on the duration of the hospital stay without increasing the complications rate.**

#### **Strong recommendation +. High Level of Evidence.**

- Srinivasa S, Kahokehr AA, Yu TC, Hill AG. Preoperative glucocorticoid use in major abdominal surgery: Systematic review and meta-analysis of randomized trials. Ann Surg 2011; 254:183-91<sup>147</sup>.
- Schmidt SC, Hamann S, Langrehr JM, Höflich C, Mittler J, Jacob D, Neuhaus P. Preoperative high-dose steroid administration attenuates the surgical stress response following liver resection: results of a prospective randomized study. J Hepatobiliary Pancreat Surg. 2007; 14(5):484-92<sup>148</sup>.
- Lemanu D, Srinivasa S, Singh P, Kahokehr A, Zargar-Shoshtari K, Hill AG. Propensity score analysis evaluating preoperative glucocorticoid administration in elective colectomy. Int J Surg. 2012;10(10):607-10<sup>149</sup>.

### III. INTRAOPERATIVE PROCEDURE

#### ROUTINE MONITORING

Routine monitoring must include an electrocardiogram (ECG with 5 branches (recommending DII and V5), non-invasive blood pressure (NIBP), pulseoximetry (% Sat O<sub>2</sub>), Inspired Oxygen Fraction(FiO<sub>2</sub>), capnography (EtCO<sub>2</sub>), temperature, fluid therapy and intraoperative glycaemia.

31. **Monitoring CO<sub>2</sub> by capnography must be compulsory in any surgery, especially in laparoscopes, as any modification in the telespirography pressure curve of CO<sub>2</sub> may be a sign of intraoperative complications.**

**Strong recommendation +. High Level of Evidence.**

- Tim Cook, Nick Woodall, Chris Frerk. 4th National Audit Project of The Royal College of Anaesthetists and The Difficult Airway Society. Major complications of airway management in the United Kingdom Report and findings March 2011<sup>150</sup>.

32. **Monitoring temperature must be central.**

**Strong recommendation +. High Level of Evidence.**

33. **Anaesthetic depth will be monitored by bispectral index (BSI).**

**Strong recommendation +. High Level of Evidence.**

- Punjasawadwong Y, Boonjeungmonkol N, Phongchiewboon A Bispectral index for improving anaesthetic delivery and postoperative recovery. Cochrane Database Syst (2007) Rev4:CD003843<sup>151</sup>.

34. **The use of objective monitoring (neurostimulation with accelerometry, mechanomyography, electromyography, kinemyography) of the neuromuscular block (NMB) is necessary, with simple stimulus parameters, post-tetanic count, train-of-four (TOF) and TOF ratio during the use of NMB to permanently know the degree of NMB.**

**Strong recommendation +. High Level of Evidence.**

- Thilen SR, Hansen BE, Ramaiah R, Kent CD, Treggiari MM, Bhananker SM. Intraoperative neuromuscular monitoring site and residual paralysis. Anesthesiology 2012;117:964-72<sup>152</sup>.
- Naguib M, Kopman AF, Ensor JE. Neuromuscular monitoring and postoperative residual curarization. A metaanalysis. Br J Anaesth 2007;98:302-16<sup>153</sup>.
- Eikermann M, Groeben H, Hüsing J, Peters J: Accelerometry of adductor pollicis muscle predicts recovery of respiratory function from neuromuscular blockade. Anesthesiology 2003;98:1333-7<sup>154</sup>.

35. **Glycaemia will be monitored, given that intraoperative hyperglycaemia may give rise to an increase in complications in the postoperative procedure, although the use of intensive therapy with insulin must be avoided, due to the risk of hypoglycaemia.**

**Strong recommendation +. High Level of Evidence.**

- Jackson RS, Amdur RL, White JC, Macsata RA. Hyperglycemia is associated with increased risk of morbidity and mortality after colectomy for cancer. J Am Coll Surg 2012;214(1):68-80<sup>155</sup>.

- Gandhi GY, Nuttall GA, Abel MD, Mullany CJ, Schaff HV, O'Brien PC, Johnson MG, Williams AR, Cutshall SM, Mundy LM, Rizza RA, McMahon MM. Intensive intraoperative insulin therapy versus conventional glucose management during cardiac surgery: a randomized trial. *Ann Intern Med* 2007;146(4):233-43<sup>156</sup>.
- Buchleitner AM, Martínez-Alonso M, Hernández M, Solà I, Mauricio D. Perioperative glycaemic control for diabetic patients undergoing surgery. *Cochrane Database Syst Rev* 2012; 9:CD007315<sup>157</sup>.

(Other studies of interest on this topic)

There is only a low level of evidence that the control of the preoperative procedure hourly urinary debit has a clinical value and that its sustained use may increase morbidity.

Bladder catheter may be maintained in the case of needs derived from surgical or physiopathological complications.

**36. When bladder catheter is placed, this will be done with appropriate asepsis measures and, if possible, it will be removed 24 hours after surgery.**

**Weak recommendation+. Moderate Level of Evidence.**

- Benoist S1, Panis Y, Denet C, Mauvais F, Mariani P, Valleur P. Optimal duration of urinary drainage after rectal resection: a randomized controlled trial. *Surgery* 1999;125(2):135-41<sup>158</sup>.
- Zmora O, Madbouly K, Tulchinsky H, Hussein A, Khaikin M. Urinary Bladder catheter drainage following pelvic surgery is it necessary for that long? *Dis Colon Rectum* 2010;53(3):321-6<sup>159</sup>.
- Basse L, Werner M, Kehlet H. Is urinary drainage necessary during continuous epidural analgesia after colonic resection? *Reg Anesth Pain Med* 2000;25(5):498-501<sup>160</sup>.

(Other studies of interest on this section<sup>161-168</sup>).

## NON-ROUTINE MONITORING

**37. Invasive monitoring is not indicated as a routine, but invasive artery channelling is useful in selected patients. Especially indicated in those patients who have severe cardiorespiratory alterations and who may have problems during postoperative procedure.**

**Strong recommendation -. Low Level of evidence**

- Kirton OC, Calabrese RC, Staff I. Increasing Use of Less-Invasive Hemodynamic Monitoring in 3 Specialty Surgical Intensive Care Units: A 5-Year Experience at a Tertiary Medical Center. *J Intensive Care Med* 2015;30(1):30-6<sup>169</sup>.
- Takala J1, Ruokonen E, Tenhunen JJ, Parviainen I, Jakob SM. Early non-invasive cardiac output monitoring in hemodynamically unstable intensive care patients: a multi-center randomized controlled trial. *Crit Care* 2011;15(3):R148<sup>170</sup>.

**38. The insertion of CVC is not indicated as a routine. It will be considered in selected cases. The use of central venous catheter is limited to patients with respiratory diseases in whom the administration of vasopressors or inotropes in continuous perfusion may be foreseen as necessary.**

**Strong recommendation -. Low Level of evidence**

- Bender JS, Smith-Meek MA, Jones CE. Routine pulmonary artery catheterization does not reduce morbidity and mortality of elective vascular surgery: results of a prospective, randomized trial. *Ann Surg* 1997;226(3):229-36; discussion 236-7<sup>171</sup>.
- Rajaram SS1, Desai NK, Kalra A, Gajera M, Cavanaugh SK, Brampton W, Young D, Harvey S, Rowan K. Pulmonary artery catheters for adult patients in intensive care. *Cochrane Database Syst Rev* 2013; Feb 28;2:CD003408<sup>172</sup>.
- Sotomi Y, Sato N, Kajimoto K, Sakata Y, Mizuno M, Minami Y, Fujii K, Takano T; investigators of the Acute Decompensated Heart Failure Syndromes (ATTEND) Registry. Impact of pulmonary artery catheter on outcome in patients with acute heart failure syndromes with hypotension or receiving inotropes: From the ATTEND Registry. *Int J Cardiol* 2014;172(1):165-72<sup>173</sup>.

## PREPARATION OF THE SKIN AND SURGICAL SITE

The skin must be disinfected before defining the surgical site. This must be done in circles, from clean to dirty. The use of chlorhexidine in 1% alcohol solution is preferable to the option of povidone-iodine.

### 39. The skin must be disinfected before defining the surgical site. This must be done in circles, from clean to dirty.

**Strong recommendation +. High Level of Evidence.**

- \*\*Dumville JC, McFarlane E, Edwards P, Lipp A, Holmes A. Preoperative skin antiseptics for preventing surgical wound infections after clean surgery. *Cochrane Database of Systematic Reviews* 2013; Issue 3: CD003949<sup>174</sup>.

### 40. The use of chlorhexidine in 1% alcohol solution as an antiseptic for the skin of the surgical site is recommended.

**Strong recommendation +. High Level of Evidence.**

- Darouiche RO, Wall Jr MJ, Itani KM, Otterson MF, Webb AL, Carrick MM, et al. Chlorhexidine Alcohol versus povidone-iodine for surgical-site antisepsis. *N Engl J Med* 2010;362(1):18-26<sup>175</sup>.
- \*Lee I, Agarwal RK, Lee BY, Fishman NO, Umscheid CA. Systematic review and cost analysis comparing use of chlorhexidine with use of iodine for preoperative skin antisepsis to prevent surgical site infection. *Infect Control Hosp Epidemiol* 2010;31(12):1219-29<sup>176</sup>.

## ANAESTHESIA INDUCTION AND MAINTENANCE

A standard anaesthesia protocol is required that permits fast awakening. The anaesthetist must control the fluid therapy, analgesia and haemodynamic stability to reduce the metabolic response to stress.

There is no Randomised Clinical Trial (RCT) that compares the general anaesthesia techniques used in colorectal surgery.

### 41. The use of short-acting induction agents is recommended, such as propofol, combined with a short-acting opioid such as fentanyl, alfentanil or remifentanyl infusion. The anaesthesia can be maintained with short-acting inhaled anaesthetics, such as sevoflurane or desflurane.



### Strong recommendation +. Low Level of evidence

- Varadhan KK, Neal KR, Dejong, C, Fearon K, Ljungqvist O, Lobo D. The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective open colorectal surgery: A meta-analysis of randomized controlled trials. *Clinical Nutrition* 2010;29(4):434-40<sup>177</sup>.
- Li R, Dexiang Z, Ye W, Xiangou P, Li L, Jianmin X, Yunshi Z, Zhanggang X, Ling J, Shaokang Z, Weixin N, Xinyu Q, Zhaohan W, Zhaoguang W. Enhanced Recovery After Surgery (ERAS) Program Attenuates Stress and Accelerates Recovery in Patients After Radical Resection for Colorectal Cancer: A Prospective Randomized Controlled Trial. *World Journal of Surgery* 2012;36 (2):407-14<sup>178</sup>.

Alternately, total intravenous anaesthesia can be used, which may be beneficial in patients that suffer from postoperative nausea and vomiting (PONV).

Short-acting muscle relaxation agents may be used under neuromuscular control. Maintaining a deep neuromuscular block during surgery helps facilitate surgical vision and access.

**42. Anaesthesia induction and maintenance may be guided by the bispectral index (BIS) monitor, thus avoiding excessively deep levels of hypnosis (BIS<30), especially in the elderly, in whom there is evidence that, if the anaesthesia is too deep, this may be harmful and may increase the risk of postoperative confusion.**

### Strong recommendation +. High Level of Evidence.

- Punjasawadwong Y, Boonjeungmonkol N, Phongchiewboon A. Bispectral index for improving anaesthetic delivery and postoperative recovery. *Cochrane Database Syst Rev* 2007; 4:CD003843<sup>179</sup>.

## SURGICAL APPROACH AND INCISIONS

Both laparoscopic and open approaches can be used in Enhanced Recovery protocols, depending on experience and available resources. A laparoscopic approach means smaller incisions, less surgical trauma and less bleeding. It has been proved that it shortens the stay and patients can go back to a normal life earlier on.

**43. The use of laparoscopic technique is recommended if there is experience.**

### Strong recommendation +. High Level of Evidence.

- Sammour T, et al. The humoral response after laparoscopic versus open colorectal surgery: a meta-analysis. *J Surg Res* 2010;164:28-37<sup>180</sup>.
- Tang CL, et al. Randomized clinical trial of the effect of open versus laparoscopically assisted colectomy on systemic immunity in patients with colorectal cancer. *Br J Surg* 2001; 88:801-7<sup>181</sup>.
- Pascual M, et al. Randomized clinical trial comparing inflammatory and angiogenic response after open versus laparoscopic curative resection for colonic cancer. *Br J Surg* 2010;98:50-9<sup>182</sup>.

**44. If open surgery is carried out, the use of transverse incisions, located low down when possible, entail less postoperative pain and fewer pulmonary complications although**

there is no clear evidence of its advantage over other types of incisions. If the use of transverse incisions is not possible, a midline incision will be made, trying to keep it as small as possible.

**Strong recommendation +. Moderate Level of Evidence.**

- Brown SR, Goodfellow PB. Transverse versus midline incisions for abdominal surgery. Cochrane Database Syst Rev, 4. Art. no.:CD005199<sup>183</sup>.

(Other studies of interest on this section<sup>184-191</sup>)

## INSPIRED INTRAOPERATIVE OXYGEN FRACTION

The oxidative power of neutrophils has proven to be one of the best defences against bacteria that reach the surgical wound. In an ambience with little oxygen, such as that of the surgical wound due to hypo microvascular flow, the leukocyte function may be altered. It has been suggested that an increase in tissue oxygen brought about by increasing the inspired fraction could possibly improve the function of neutrophils, reducing the prevalence of surgical wound infection. Likewise, it could also contribute to a decrease in the prevalence of postoperative nausea and vomiting.

45. Intra-operative administration of high oxygen concentrations (at least FiO<sub>2</sub>: 50%) is a supplementary strategy that decreases the risk of infection of the surgical wound in patients who require abdominal surgery and who receive antibiotic prophylaxis.

**Strong recommendation +. High Level of Evidence.**

- Hovaguimian F, Lysakowski C, Elia N et al. Effect of intraoperative high inspired oxygen fraction on surgical site infection, postoperative nausea and vomiting, and pulmonary function. Anesthesiology 2013;119:303-16<sup>192</sup>.

46. High inspired oxygen fraction reduces the risk of postoperative nausea and vomiting, most especially in patients who receive inhaled anaesthetics without antiemetic prophylaxis.

**Strong recommendation +. High Level of Evidence.**

- Hovaguimian F, Lysakowski C, Elia N et al. Effect of intraoperative high inspired oxygen fraction on surgical site infection, postoperative nausea and vomiting, and pulmonary function. Anesthesiology 2013;119:303-16<sup>192</sup>.

47. A high oxygen concentration does not increase the prevalence of postoperative atelectasis.

**Strong recommendation +. High Level of Evidence.**

- Hovaguimian F, Lysakowski C, Elia N et al. Effect of intraoperative high inspired oxygen fraction on surgical site infection, postoperative nausea and vomiting, and pulmonary function. Anesthesiology 2013;119:303-16<sup>192</sup>.

(Other studies of interest on this section<sup>193-197</sup>)

## INTRAOPERATIVE NORMOTHERMIA

Maintaining the patient's normothermia during surgery is an effective measure that may lead to a decrease in intraoperative complications, such as bleeding, as well as a decrease in the



prevalence of postoperative complications, such as infection of the surgical wound, thus reducing the hospital stay.

#### 48. Avoiding intraoperative hypothermia in abdominal surgery is recommended.

##### **Strong recommendation +. High Level of Evidence.**

- Wong PF, Kumar S, Bohra A, Whetter D, Leaper DJ. Randomized clinical trial of perioperative systemic warming in major elective abdominal surgery. *Br J Surg* 2007;94(4):421-6<sup>198</sup>.
- Birch DW, Manouchehri N, Shi X, Hadi G, Karmali S. Heated CO(2) with or without humidification for minimally invasive abdominal surgery. *Cochrane Database Syst Rev* (2011); 19(1):CD007821<sup>199</sup>.
- Sajid MS, Shakir AJ, Khatri K, Baig MK. The role of perioperative warming in surgery: a Systematic Review. *Sao Paulo Med J* 2009;127(4):231-7<sup>200</sup>.

(Other studies of interest on this section<sup>201-205</sup>).

### PROPHYLAXIS OF POSTOPERATIVE NAUSEA AND VOMITING

Postoperative nausea and vomiting (PONV) is the most important cause of delays in the start of oral tolerance to liquids and this may be more discomfortant for patients than the pain. It affects 25-35% of all surgical patients and is an important cause of discomfort and delay in medical discharge. The prophylaxis must be carried out depending on the estimated risk.

#### Measures for prophylaxis and treatment:

##### **1. Identification of patients with risk of PONV**

The risk of PNOV must be assessed in any patient via the "Apfel" scale, where risk factors for PONV are assessed: female gender, PONV history, non-smoker, administration of morphic agents in postoperative procedure. Patients under the age of 50 have a greater risk of PONV.

#### 49. The risk of PONV must be stratified in all patients via the Apfel scale, performing prophylaxis according to the result.

##### **Strong recommendation +. High Level of Evidence.**

- Apfel CC, Philip BK, Cakmakaya OS, Shilling A, Shi YY, Leslie JB, Allard M, Turan A, Windle P, Odom-Forren J, Hooper VD, Radke OC, Ruiz J, Kovac A. Who is at risk for post-discharge nausea and vomiting after ambulatory surgery? *Anesthesiology* 2012;117:475-86<sup>206</sup>.

##### **2. Decrease of basal risk of PONV**

A reduction of basal risk factors of PONV decreases their prevalence. Strategies to minimise them in risk patients include:

#### 50. Use of propofol for anaesthesia induction and maintenance in patients with a high risk of PONV.

##### **Strong recommendation +. High Level of Evidence.**

- Apfel CC, Korttila K, Abdalla M, Kerger H, Turan A, Vedder I, et al; IMPACT Investigators. A factorial trial of six interventions for the prevention of postoperative nausea and vomiting. *N Engl J Med* 2004;350:2441-51<sup>207</sup>.

### 51. Avoid the use of nitrous oxide in patients with high risk of PONV

#### Strong recommendation +. High Level of Evidence.

- Tramèr M, Moore A, McQuay H. Omitting nitrous oxide in general anaesthesia: metaanalysis of intraoperative awareness and postoperative emesis in randomized controlled trials. *Br J Anaesth* 1996;76:186-93<sup>208</sup>.

### 52. Avoid the use of inhaled anaesthetics in patients with high risk of PONV

#### Strong recommendation +. High Level of Evidence.

- Apfel CC, Kranke P, Katz MH, Goepfert C, Papenfuss T, Rauch S, Heineck R, Greim CA, Roewer N. Volatile anaesthetics may be the main cause of early but not delayed postoperative vomiting: a randomized controlled trial of factorial design. *Br J Anaesth* 2002;88:659-68<sup>209</sup>.

### 53. Minimise the risk of intraoperative and postoperative opioids.

#### Strong recommendation +. High Level of Evidence.

- Roberts GW, Bekker TB, Carlsen HH, Moffatt CH, Slattery PJ, McClure AF. Postoperative nausea and vomiting are strongly influenced by postoperative opioid use in a dose related manner. *Anesth Analg* 2005;101:1343-8<sup>210</sup>.
- Jørgensen H, Wetterslev J, Møiniche S, Dahl JB. Epidural local anaesthetics vs opioid-based analgesic regimens on postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery. *Cochrane Database Syst Rev* 2000;(4):CD001893<sup>211</sup>.

### 3. Prophylactic treatment of PONV in patients according to risk (*Apfel Scale*)

#### Very low or low risk (Apfel 0-1)

### 54. Prophylaxis is not indicated in all patients, except in high risk surgery, including laparoscopic, laparotomy, urological, breast, plastic and maxillofacial surgery. In this case, prophylaxis will be carried out with pharmacological monotherapy by means of dexamethasone in anaesthesia induction or droperidol when surgery ends.

#### Strong recommendation -. High Level of Evidence.

- Wang JJ, Ho ST, Lee SC, Liu YC, Ho CM. The use of dexamethasone for preventing postoperative nausea and vomiting in females undergoing thyroidectomy: a dose-ranging study. *Anesth Analg* 2000;91:1404-7<sup>212</sup>.
- Wang JJ, Ho ST, Tzeng JI, Tang CS. The effect of timing of dexamethasone administration on its efficacy as a prophylactic antiemetic for postoperative nausea and vomiting. *Anesth Analg* 2000;91:136-9<sup>213</sup>.
- Henzi I, Sonderegger J, Tramèr MR. Efficacy, dose-response, and adverse effects of droperidol for prevention of postoperative nausea and vomiting. *Can J Anaesth* 2000;47:537-51<sup>214</sup>.

#### Moderate risk (Apfel 2-3)

### 55. Measures are indicated to decrease basal risks as well as dual pharmacological therapy with dexamethasone and droperidol or ondansetron.

**Strong recommendation +. High Level of Evidence.**

- Wang JJ, Ho ST, Lee SC, Liu YC, Ho CM. The use of dexamethasone for preventing postoperative nausea and vomiting in females undergoing thyroidectomy: a dose-ranging study. *Anesth Analg* 2000;91:1404-7<sup>212</sup>.
- Wang JJ, Ho ST, Tzeng JI, Tang CS. The effect of timing of dexamethasone administration on its efficacy as a prophylactic antiemetic for postoperative nausea and vomiting. *Anesth Analg* 2000;91:136-9<sup>213</sup>.
- Henzi I, Sonderegger J, Tramèr MR. Efficacy, dose-response, and adverse effects of droperidol for prevention of postoperative nausea and vomiting. *Can J Anaesth* 2000; 47:537-51<sup>214</sup>.
- Tramèr MR, Reynolds DJ, Moore RA, McQuay HJ. Efficacy, dose-response, and safety of ondansetron in prevention of postoperative nausea and vomiting: a quantitative systematic review of randomized placebo-controlled trials. *Anesthesiology* 1997; 87:1277-89<sup>215</sup>.

**High risk (Apfel 4)**

56. Measures to reduce basal risks are indicated as well as pharmacological prophylaxis with triple therapy by means of dexamethasone, droperidol and ondansetron. Administering the latter when surgery ends.

**Strong recommendation +. High Level of Evidence for treatment.**

- Tramèr MR, Reynolds DJ, Moore RA, McQuay HJ. Efficacy, dose-response and safety of ondansetron in prevention of postoperative nausea and vomiting: a quantitative systematic review of randomized placebo-controlled trials. *Anesthesiology* 1997;87:1277-89<sup>215</sup>.

**Strong recommendation +. Moderate level of evidence for administration time.**

- Sun R, Klein KW, White PF. The effect of timing of ondansetron administration in outpatients undergoing otolaryngologic surgery. *Anesth Analg* 1997;84:331-6<sup>216</sup>.

57. The administration of combined therapy is preferable to monotherapy in patients with moderate to high risk.

**Strong recommendation +. High Level of Evidence.**

- Habib AS, El-Moalem HE, Gan TJ. The efficacy of the 5-HT<sub>3</sub> receptor antagonists combined with droperidol for PONV prophylaxis is similar to their combination with dexamethasone. A meta-analysis of randomized controlled trials. *Can J Anaesth* 2004;51:311-9<sup>217</sup>.

**4. Treatment of PONV in patients with failed prophylaxis**

58. In cases where PONV occurs, treatment must be started with an antiemetic of a different family to that used for the prophylaxis. If no prophylaxis has been carried out, the use of low-dose ondansetron is recommended.

**Strong recommendation +. High Level of Evidence.**

- Kazemi-Kjellberg F, Henzi I, Tramèr MR. Treatment of established postoperative nausea and vomiting: a quantitative systematic review. *BMC Anesthesiol* 2001;1:2-12<sup>218</sup>.

**ROUTINE USE OF NASOGASTRIC TUBE IN A PROPHYLACTIC MANNER**

The use of nasogastric tube (NGT) is not recommended as gastrointestinal decompression due to:

Slower start of oral tolerance, increasing hospital stay, not improving the intestinal function, not preventing from failure in anastomosis, infections, fascia dehiscence or incisional hernia; not preventing pulmonary complications (atelectasia, aspiration, pneumonia, fever and pharyngolaryngitis) or abdominal discomfort (distension, nausea and vomiting). Patients start to return to intestinal mobility earlier on without NGT, starting oral tolerance again in 80-90% of patients during the first 24 hours, associating a shorter hospital stay, less risk of infection and improvement of hyperglycaemic control.

## 59. The use of nasogastric tube is not recommended.

### Strong recommendation +. High Level of Evidence.

- Cheatham ML, Chapman WC, Key SP, Sawyers JL. A meta-analysis of selective versus routine nasogastric decompression after elective laparotomy. *Ann Surg* 1995;221(5):469-76; Discussion 476-478<sup>219</sup>.
- Nelson R, Edwards S, Tse B. Prophylactic nasogastric decompression after abdominal surgery. [Update of: *Cochrane Database Syst Rev* 2007;(3): CD004929] *Cochrane Database Syst Rev* 2007;(3):CD004929<sup>220</sup>.
- Lei WZ, Zhao GP, Cheng Z, Li K, Zhou ZG. Gastrointestinal decompression after excision and anastomosis of lower digestive tract. *World J Gastroenterol* 2004;10(13):1998-2001<sup>221</sup>.
- Zhou T, Wu XT, Zhou YJ, Huang X, Fan W, Li YC. Early removing gastrointestinal decompression and early oral feeding improve patients' rehabilitation after colectostomy. *World J Gastroenterol* 2006;12(15):2459-63<sup>222</sup>.
- Otchy DP, Wolff BG, van Heerden JA, Ilstrup DM, Weaver AL, Winter LD. Does the avoidance of nasogastric decompression following elective abdominal colorectal surgery affect the incidence of incisional hernia? Results of a prospective, randomized trial. *Dis Colon Rectum* 1995;38(6):604-8<sup>223</sup>.
- Cunningham J, Temple WJ, Langevin JM, Kortbeek J. A prospective randomized trial of routine postoperative nasogastric decompression in patients with bowel anastomosis. *Can J Surg* 1992;35(6):629-32<sup>224</sup>.
- Petrelli NJ, Stulc JP, Rodriguez-Bigas M, Blumenson L. Nasogastric decompression following elective colorectal surgery: a prospective randomized study. *Am Surg* 1993;59(10):632-5<sup>225</sup>.

## INTRAOPERATIVE FLUID THERAPY

Perioperative fluid therapy has a direct effect on the results; the prescription of liquids must adapt to the patient's individual needs. The objective of fluid therapy in patients who are going to undergo surgery is to maintain an adequate circulatory volume, avoiding overload as much as possible, trying to achieve zero balance in the perioperative procedure, preventing weight gain.

The use of goal-directed fluid therapy (GDFT) may reduce postoperative complications and hospital stay, whereas a reduction in associated mortality cannot be demonstrated. A reduction in hospital stay is achieved in high and low risk patients and it is this, together with the complications that give rise to an increase in health expenditure. Although its use in surgeries and high risk patients is more justified.

There is no ideal monitoring for GDFT, as each one has its advantages and disadvantages, maintaining correct tissue oxygen intake by obtaining normal or supra-normal haemodynamic values in order to achieve results and reduce complications.

There are not sufficient trials that compare the same operation with different devices and there is no proof that these are interchangeable, as the same results are not obtained when they are compared with the same algorithm.

The use of algorithms in which treatment with fluids, vasoconstrictors and inotropes is carried out is more beneficial. Although, monitoring with oesphagic doppler was recommended by NICE in 2011 in high-risk patients and in patients in whom invasive monitoring is considered, the authors conclude that the use of a certain GDFT algorithm must be planned depending on the monitoring available at each centre, the morbidity of the patient and the type of surgical operation, as in high-risk patients, invasive arterial monitoring is reasonable.

A basic algorithm of action is presented in figure 4 (modified from Feldheiser A 2012).

## SUMMARY AND RECOMMENDATIONS

### 60. The use of SV (Stroke Volume) or of SVV (Stroke Volume Variation) by monitoring is recommended to guide the intraoperative administration of fluids.

#### **Strong recommendation +. High Level of Evidence.**

- Grocott MPW, Dushianthan A, Hamilton MA, et al. Perioperative increase in global blood flow to explicit defined goals and outcomes after surgery: A Cochrane Systematic Review. *Br J Anaesth* 2013;111:535-48<sup>226</sup>.

### 61. The administration of fluids is indicated in those cases where there is a drop in SV > 10% or of SVV > 10%.

#### **Strong recommendation +. High Level of Evidence.**

- Wakeling HG, McFall MR, Jenkins CS, Woods WGA, Miles WFA, Barclay GR, et al. Intraoperative oesophageal Doppler guided fluid management shortens postoperative hospital stay after major bowel surgery. *Br J Anaesth* 2005;95:634-42<sup>227</sup>.
- Scheeren, T. W. L., Wiesenack, C., Gerlach, H. & Marx, G. Goal-directed intraoperative fluid therapy guided by stroke volume and its variation in high-risk surgical patients: A prospective randomized multicentre study. *J Clin Monit Comput* 2013;27:249-57<sup>228</sup>.

### 62. Restrictive continuous fluid perfusion must be maintained in order to avoid fluid overload.

#### **Strong recommendation +. High Level of Evidence.**

- Brandstrup B, Tønnesen H, Beier-Holgersen R, Hjortsø E, Ørding H, Lindorff-Larsen K, et al., Danish Study Group on Perioperative Fluid Therapy: Effects of intravenous fluid restriction on postoperative complications: comparison of two perioperative fluid regimens randomized assessor-blinded multicenter trial. *Ann Surg* 2003;238:641-8<sup>229</sup>.
- \*Brandstrup B, Svendsen PE, Rasmussen M, Belhage B, Rodt SA, Hansen B, Moller DR, Lundbech LB, Andersen N, Berg V, Thomassen N, Andersen ST & Simonsen L. Which goal for fluid therapy during colorectal surgery is followed by the best outcome: Near maximal stroke volume or zero fluid balance? *Br J Anaesth* 2012;109:235-41<sup>230</sup>.

### 63. Intraoperative hypotension must be treated with vasopressors.

#### **Strong recommendation +. High Level of Evidence.**

- Zheng H, Guo H, Ye JR, Chen L & Ma HP. Goal-directed fluid therapy in gastrointestinal surgery in older coronary heart disease patients: randomized trial. *World J Surg* 2013;37:2820-29<sup>231</sup>.

#### 64. A mean blood pressure range of 70 mmHg must be established

**Strong recommendation +. Moderate Level of Evidence.**

- Monk TG, Saini V, Weldon BC, et al: Anesthetic management and one-year mortality after noncardiac surgery. *Anesth Analg* 2005;100:4-10<sup>232</sup>.

#### 65. A CI of > 2.5 l/min/m<sup>2</sup> must be maintained, using inotropes in cases where there is no response to volume.

**Strong recommendation +. Moderate Level of Evidence.**

- Jhanji S, Vivian-Smith A, Lucena-Amaro S, Watson D, Hinds CJ, Pearse RM. Haemodynamic optimisation improves tissue microvascular flow and oxygenation after major surgery: a randomised controlled trial. *Crit Care* 2010;14:R151<sup>233</sup>.
- Arulkumaran N, Corredor C, Hamilton MA, Ball J, Grounds RM, Rhodes A, Cecconi M. Cardiac complications associated with goal-directed therapy in high-risk surgical patients: a meta-analysis. *Br J Anaesth* 2014;112(4):648-59<sup>234</sup>.

#### 66. Monitoring with oesophageic doppler is preferred, or else methods based on validated pulse contour analyses.

**Strong recommendation +. Moderate Level of Evidence.**

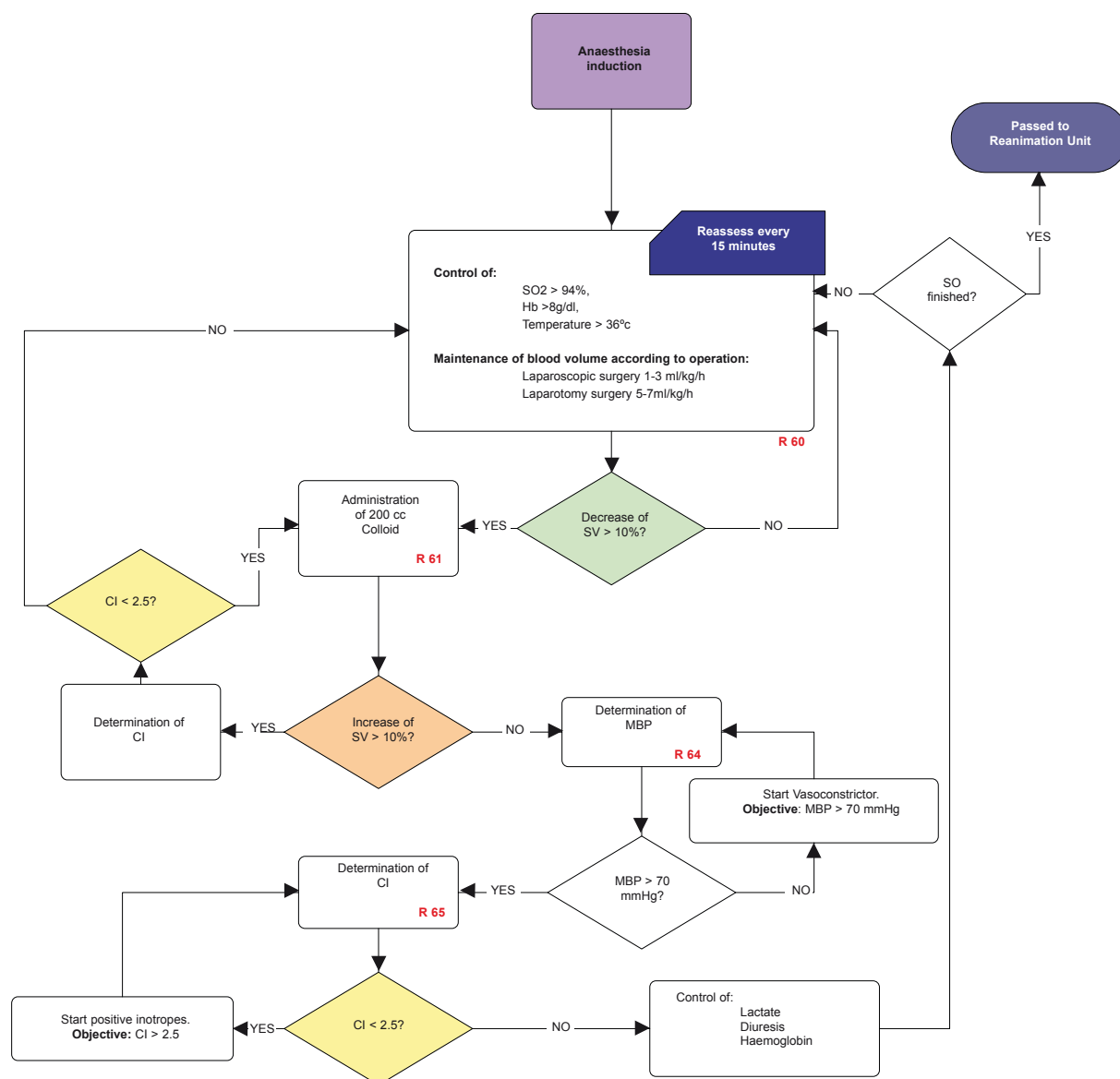
- Feldheiser, Hunsicker O, Krebbel H, Weimann K, Kaufner L, Wernecke KD, and Spies C. Oesophageal Doppler and calibrated pulse contour analysis are not interchangeable within a goal-directed haemodynamic algorithm in major gynaecological surgery. *Br J Anaesth* 2014[Epub ahead of print]<sup>235</sup>.
- Zakhaleva J, Tam J, Denoya PI, Bishawi M & Bergamaschi R. The impact of intravenous fluid administration on complication rates in bowel surgery within an enhanced recovery protocol: a randomized controlled trial. *Colorectal Dis* 2013;15:892-9<sup>236</sup>.
- Salzwedel C, Puig J, Carstens A, Bein B, Molnar Z, Kiss K, Hussain A, Belda J, Kirov M & Sakka S. Perioperative goal-directed hemodynamic therapy based on radial arterial pulse pressure variation and continuous cardiac index trending reduces postoperative complications after major abdominal surgery: a multi-center, prospective, randomized study. *Crit Care* 2013;17(5):R191<sup>237</sup>.
- Mayer J, Boldt J, Mengistu AM, Rohm KD & Suttner S. Goal-directed intraoperative therapy based on autocalibrated arterial pressure wave form analysis reduces hospital stay in high-risk surgical patients: a randomized, controlled trial. *Crit Care* 2010;14:R18<sup>238</sup>.

(Other studies of interest on this section<sup>239-250</sup>)



Figure 4

# Algorithm of goal-guided fluid therapy (GDFT)



Recommendations for goal-directed fluid therapy:  
From R 60 to R 66

CI: Cardiac Index  
SO: Surgical Operation  
MBP: Mean blood pressure  
SV: Stroke volume

## NEUROMUSCULAR BLOCK AND OPIATE DRUG REVERSAL

### NEUROMUSCULAR BLOCK

Different factors intervene to have a better view of the laparoscopic site with pneumoperitoneum, which improve and lead to less intra-abdominal pressure: woman, previous pregnancies, peripheral obesity, previous laparoscopes, Trendelenburg position, leg bending. From the anaesthetist's viewpoint, it is only possible to impact on neuromuscular block and the use of halogenated vapours.

67. TOF (train of four) deep neuromuscular block (NMB)=0, with at least 1 or 2 post-tetanic count responses, or depending on the patient, a moderate block with no more than 1 TOF response, can allow the surgeon to have a better view of the laparoscopic site, so it would be recommendable to maintain this blockade level with NMB in boluses or in continuous perfusion until the end of the operation with pneumoperitoneum, to maintain intra-abdominal pressures < 8-10 cmH<sub>2</sub>O.

#### Weak recommendation +. High Level of Evidence.

- Geldner G, Niskanen M, Laurila P, Mizikov V, Hübner M, Beck G, Rietbergen H, Nicolayenko E. A randomized controlled trial comparing sugammadex and neostigmine at different depths of neuromuscular blockade in patients undergoing laparoscopic surgery. *Anaesthesia* 2012;67:991-8<sup>251</sup>.
- Martini CH, Boon M, Bevers RF, Aarts LP, Dahan A. Evaluation of surgical conditions during laparoscopic surgery in patients with moderate vs deep neuromuscular block. *Br J Anaesth* 2014;112:498-505<sup>252</sup>.
- Dubois PE, Mulier JP. A review of the interest of sugammadex for deep neuromuscular blockade management in Belgium. *Acta Anaesthesiol Belg* 2013;64:49-60<sup>253</sup>.

68. The use of objective monitoring (neurostimulation with accelerometry, mechanomyography, electromyography, kinemyography) of the NMB is necessary, with simple stimulus parameters, post-tetanic count, TOF and TOF ratio during the use of NMB to permanently know the degree of NMB.

#### Strong recommendation +. High Level of Evidence.

- Thilen SR, Hansen BE, Ramaiah R, Kent CD, Treggiari MM, Bhananker SM. Intraoperative neuromuscular monitoring site and residual paralysis. *Anesthesiology* 2012;117:964-72<sup>254</sup>.
- Naguib M, Kopman AF, Ensor JE. Neuromuscular monitoring and postoperative residual curarization: a meta-analysis. *Br J Anaesth* 2007;98:302-16<sup>255</sup>.

### REVERSAL OF NEUROMUSCULAR BLOCK

69. A TOF ratio > 0.9 in short adductor of the thumb is necessary in anaesthetic reduction prior to extubation. There is an association between residual NMB and an increase in mortality and of postoperative respiratory and pulmonary complications. There is greater mortality especially with long-lasting NMB.

#### Strong recommendation +. High Level of Evidence.

- Eikermann M, Groeben H, Hüsing J, Peters J. Accelerometry of adductor pollicis muscle predicts recovery of respiratory function from neuromuscular blockade. *Anesthesiology* 2003; 98:1333-7<sup>256</sup>.



70. There is scientific evidence that TOF ratio values  $< 0.9$  have a greater risk of suffering respiratory complications, hypoxemia and oxygen desaturation during transfer and arrival at reanimation, including the need for re-intubation.

**Strong recommendation +. High Level of Evidence.**

- Murphy GS, Szokol JW, Marymont JH, Greenberg SB, Avram MJ, Vender JS, Nisman M. Intraoperative acceleromyographic monitoring reduces the risk of residual neuromuscular blockade and adverse respiratory events in the postanesthesia care unit. *Anesthesiology* 2008;109:389-98<sup>257</sup>.
- Murphy GS, Szokol JW, Avram MJ, Greenberg SB, Marymont JH, Vender JS, Gray J, Landry E, Gupta DK. Intraoperative acceleromyography monitoring reduces symptoms of muscle weakness and improves quality of recovery in the early postoperative period. *Anesthesiology* 2011;115:946-54<sup>258</sup>.
- Murphy GS, Szokol JW, Avram MJ, Greenberg SB, Shear T, Vender JS, Gray J, Landry E. Postoperative residual neuromuscular blockade is associated with impaired clinical recovery. *Anesth Analg* 2013;117:133-41<sup>259</sup>.
- Murphy GS, Szokol JW, Marymont JH, Greenberg SB, Avram MJ, Vender JS. Residual neuromuscular blockade and critical respiratory events in the postanesthesia care unit. *Anesth Analg*. 2008;107:130-7<sup>260</sup>.
- Murphy GS, Szokol JW, Marymont JH, Franklin M, Avram MJ, Vender JS. Residual paralysis at the time of tracheal extubation. *Anesth Analg* 2005;100:1840-5<sup>261</sup>.
- Eikermann M, Vogt FM, Herbstreit F, Vahid-Dastgerdi M, Zenge MO, Ochterbeck C, de Greiff A, Peters J. The predisposition to inspiratory upper airway collapse during partial neuromuscular blockade. *Am J Respir Crit Care Med* 2007;175:9–15<sup>262</sup>.

71. To reach a TOF ratio  $> 0.9$  it is necessary; if starting with deep blockade; reverting with sugammadex, 4 mg/kg, or in the case of moderate blockade, with 1 or 2 responses to TOF of 2 mg/kg in weight, if aminosteroid NMB has been used, such as rocuronium and vecuronium and, extubation must not be carried out until a TOF ratio  $> 0.9$  is reached. When there are less than 3-4 TOF responses, the NMB can be reverted with neostigmine and atropin, and extubation must not be carried out until TOF ratio  $> 0.9$ .

**Strong recommendation +. High Level of Evidence.**

- Abrishami A, Ho J, Wong J, Yin L, Chung F. Sugammadex, a selective reversal medication for preventing postoperative residual neuromuscular blockade. *Cochrane Database Syst Rev* 2009;7(4):CD007362<sup>263</sup>.
- Pühringer FK, Rex C, Sielenkämper AW, Claudius C, Larsen PB, Prins ME, Eikermann M, Khuenl-Brady KS. Reversal of profound, high-dose rocuronium-induced neuromuscular blockade by sugammadex at two different time points: an international, multicenter, randomized, dose-finding, safety assessor-blinded, phase II trial. *Anesthesiology* 2008;109:188-97<sup>264</sup>.
- Tramèr MR, Fuchs-Buder T. Omitting antagonism of neuromuscular block: effect on postoperative nausea and vomiting and risk of residual paralysis. A systematic review. *Br J Anaesth* 1999;82:302-16<sup>265</sup>.

72. Sugammadex, 2 mg/kg, can be used instead of atropin and neostigmine, when there is residual blockade, with TOF  $< 0.9$ , or moderate blockade, with 1-3 responses of TOF, in

patients with mitochondrial myopathies, dystrophies and muscular myopathy, myasthenia gravis, past history of tachyarrhythmias and ischaemic cardiopathy, in the very elderly, severe malnutrition, chronic bronchitis and asthma, slow NMB metabolisers, sleep obstructive apnoea syndrome (SOAS) and morbid obesity.

**Strong recommendation +. Moderate Level of Evidence.**

- Montealegre-Angarita MC, Llauro-Paco S, Sabaté A, Ferreres E, Cabrera A, Camprubí I. Analysis of difficult intubation factors in bariatric surgery. Influence of the choice of neuromuscular blocker on the availability of sugammadex. *Rev Esp Anesthesiol Reanim* 2013; 60:434-9<sup>266</sup>.

73. If benzyl quinoline NMB are used such as atracurium, cisatracurium or mivacurium, reversal must be carried out when there are at least 3-4 responses of TOF, with neostigmine (0.05 – 0.09 mg/kg) and atropine (0.01 mg/kg), and extubation must not be carried until TOF ratio > 0.9. Reversal cannot be carried out with sugammadex.

**Strong recommendation +. High Level of Evidence.**

- Naguib M, Kopman AF, Lien CA, Hunter JM, Lopez A, Brull SJ. A survey of current management of neuromuscular block in the United States and Europe. *Anesth Analg* 2010; 111:110-9<sup>267</sup>.

74. NMB can be used in morbid obesity based on real weight and using sugammadex if rocuronium or vecuronium has been used, to revert based on this real weight. If the NMB is carried out based on corrected weight, sugammadex, on being combined in an equimolar manner, must be used based on the same corrected weight.

**Weak recommendation +. Moderate Level of Evidence.**

- Sanfilippo M, Alessandri F, Wefki Abdelgawwad Shousha AA, Sabba A, Cutolo A. Sugammadex and ideal body weight in bariatric surgery. *Anesthesiol Res Pract* 2013;2013:389782<sup>268</sup>.
- Gaszynski T, Szewczyk T, Gaszynski W. Randomized comparison of sugammadex and neostigmine for reversal of rocuronium-induced muscle relaxation in morbidly obese undergoing general anaesthesia. *Br J Anaesth* 2012;108:236-9<sup>269</sup>.
- Carron M, Veronese S, Foletto M, Ori C. Sugammadex allows fast-track bariatric surgery. *Obes Surg* 2013;23:1558-63<sup>270</sup>.
- Llauro S, Sabaté A, Ferreres E, Camprubí I, Cabrera A. Sugammadex ideal body weight dose adjusted by level of neuromuscular blockade in laparoscopic bariatric surgery. *Anesthesiology* 2012;117:93-8<sup>271</sup>.
- Van Lancker P, Dillemans B, Bogaert T, Mulier JP, De Kock M, Haspeslagh M. Ideal versus corrected body weight for dosage of sugammadex in morbidly obese patients. *Anaesthesia* 2011;66 (8):721-5<sup>272</sup>.

(Other studies of interest on this section<sup>273-275</sup>)

## OPIATE REVERSAL

Opiate-induced postoperative ileus consists of a temporary deficiency of digestive tract motility after abdominal surgery or surgery of another type; it is characterised by abdominal distension, absence of intestinal sounds, accumulation of gas and liquids in the intestine and delayed expulsion of wind and defecation. All of the above can contribute to pain and discomfort, reducing the pa-

tients' capacity to take oral nutrition, increasing the risk of pulmonary complications (due to gastric reflux and immobility) and increasing the duration of the hospital stay. Opiate antagonists studied have included Alvimopan, Methylnaltrexone, Naloxone and Nalbuphine.

Methylnaltrexone and Alvimopan are better than placebo to revert constipation and the increase in time of opiate-induced gastrointestinal transit. Alvimopan seems to be safe and effective in the treatment of postoperative ileus. On the other hand, there is not sufficient proof to confirm the safety or effectiveness of Naloxone or Nalbuphine in the treatment of opiate-induced bowel dysfunction.

## 75. The use of Naloxone is not recommended to revert the effects of opioids.

### Weak recommendation -. Low Level of evidence

- McNicol ED, Boyce D, Schumann R, Carr DB. Mu-opioid antagonists for opioid-induced bowel dysfunction. Cochrane Database Syst Rev 2008 Apr 16;(2):CD006332<sup>276</sup>.

(Other studies of interest on this section<sup>277-280</sup>)

## PERIOPERATIVE ANALGESIA

Controlling pain has been a key point in multimodal rehabilitation strategies since their creation.

The search for an analgesia method that confers a high degree of comfort for the patient, without interfering with other key points of the multimodal rehabilitation strategy, such as early mobilisation, paralytic ileus or postoperative nausea and vomiting, or that might increase the rate of complications or average stay, has led to the assessment of a considerable number of perioperative analgesic strategies to form part of the multimodal rehabilitation strategies.

Classically, the majority of studies conducted on perioperative analgesia offered comparisons between the use of intravenous opiates and the catheterisation and infiltration of the epidural space at thoracic level with local anaesthetics, with or without added opiates, with clear superiority of the latter over the former, in major abdominal surgery. However, although thoracic epidural catheterisation is currently the technique of choice in major open abdominal surgery, the development of minimally invasive surgical techniques, infiltration with local anaesthetics of the access ports and the development of ultrasound-guided peripheral nerve block analgesia techniques, such as the transversus abdominis plane block, or of the rectus sheaths and the non-innocuous nature of the epidural catheterisation technique mean that the advisability of thoracic epidural catheterisation is placed in doubt in major abdominal surgery in operations carried out with laparoscopic technique.

Finally, we are obliged to indicate the importance of coadjutants within the multimodal rehabilitation analgesic strategies. Some of them are more traditionally used such as non-steroid anti-inflammatories, but others have only been used more recently or are controversial, such as intravenous lidocaine, ketamine, magnesium sulphate or dexmedetomidine, which must also be taken into account when implementing an analgesic action line in a multimodal rehabilitation process.

The different analgesic modalities are described below.

## EPIDURAL ANALGESIA

There are both meta-analyses and randomised clinical trials, all of high quality, that confirm the superiority of epidural analgesia with respect to intravenous opioid analgesia, both in terms of analgesic quality and in the smaller number of complications, the shorter average hospital stay, an improvement in mobilisation times, a decrease in the intake of supplementary analgesics and in the request for rescues. The number of adverse perioperative cardiac events is less in patients who have

received analgesia at epidural level, but there is controversy regarding the efficacy of the epidural analgesia to reduce the adverse effects at pulmonary level.

Epidural analgesia has proved to improve the gastrointestinal blood flow, providing a potential benefit in patients undergoing major abdominal surgery. However, this increase in flow is not accompanied by an increase in the patient's oxygen intake.

Further to the above, epidural analgesia is accompanied by a lower endocrine and metabolic response, although it is accompanied by a certain degree of haemodynamic instability due to the sympathetic blockade produced by the epidural catheterisation that can easily be solved with vasoconstrictors.

## 76. Epidural analgesia must be performed within combined anaesthesia on all patients who undergo open major abdominal surgery procedures.

### Strong recommendation +. High Level of Evidence.

- Werawatganon T, Charuluxanun S. Patient controlled intravenous opioid analgesia versus continuous epidural analgesia for pain after intra-abdominal surgery. *Cochrane Database Syst Rev* 2005;(1):CD004088<sup>281</sup>.
- Ong CK-S, Lirk P, Seymour RA, Jenkins BJ. The efficacy of preemptive analgesia for acute postoperative pain management: a meta-analysis. *Anesth Analg* 2005;100(3):757–73<sup>282</sup>.
- De Oliveira RM, Tenório SB, Tanaka PP, Precoma D. Control of pain through epidural block and incidence of cardiac dysrhythmias in postoperative period of thoracic and major abdominal surgical procedures: a comparative study. *Rev Bras Anesthesiol* 2012;62(1):10-8<sup>283</sup>.
- Limberi S, Markou N, Sakayianni K, Vourliotou A, Kremastinou F, Savari E, et al. Coronary artery disease and upper abdominal surgery: impact of anesthesia on perioperative myocardial ischemia. *Hepatogastroenterology* 2003;50(54):1814-20<sup>284</sup>.
- Lawrence VA, Cornell JE, Smetana GW, American College of Physicians. Strategies to reduce postoperative pulmonary complications after noncardiothoracic surgery: systematic review for the American College of Physicians. *Ann Intern Med* 2006;144(8):596-608<sup>285</sup>.
- Levy BF, Fawcett WJ, Scott MJP, Rockall TA. Intra-operative oxygen delivery in infusion volume-optimized patients undergoing laparoscopic colorectal surgery within an enhanced recovery programme: the effect of different analgesic modalities. *Colorectal Dis Off J Assoc Coloproctology G B Irel.* 2012;14(7):887-92<sup>286</sup>.
- Goldmann A, Hoehne C, Fritz GA, Unger J, Ahlers O, Nachtigall I, et al. Combined vs. Isoflurane/Fentanyl anesthesia for major abdominal surgery: Effects on hormones and hemodynamics. *Med Sci Monit Int Med J Exp Clin Res* 2008;14(9):CR445-52<sup>287</sup>.

Epidural catheterisation in laparoscopic major abdominal surgery presents better analgesic results than intravenous opiates; however, on a global level, there are no significant differences in terms of postoperative complications. Epidural catheterism does not show, either, a decrease in average post-surgical stay or an increase in discomfort and increased anxiety derived from the technique. However, there is a difference in opinion about whether it would improve the return to normal bowel function. There are articles in favour and against, although, with little consistency in favour of the latter. There are no significant differences either in terms of hormone levels resulting from the response to surgical stress.

The haemodynamic instability profile is similar in laparoscopic surgery with respect to open surgery. However, patients who undergo laparoscopic surgery on whom epidural catheterisation has

been carried out, have a better intraoperative respiratory profile, improved oxygenisation levels, lower levels of serum lactate, and it would be a good option for patients with restrictive pathology or with small vital capacity. Likewise, it would also improve visceral blood flow. In view of the above, the risk-benefit of the technique indicates that the use of epidural catheterism must be chosen individually, especially in patients with a worse foreseen pulmonary profile. For all other patients, another type of analgesic strategies should be proposed, such as transversus plane block, the application of spinal analgesia or patient-controlled opioid analgesia, trying to avoid the use of medium-to-long life opioids.

**77. Despite the better analgesic profile, given the risk-benefit of the technique, epidural catheterisation is not recommended as a routine analgesic method in laparoscopic major abdominal surgery.**

**Strong recommendation +. High Level of Evidence.**

- Levy BF, Tilney HS, Dowson HMP, Rockall TA. A systematic review of postoperative analgesia following laparoscopic colorectal surgery. *Colorectal Dis Off J Assoc Coloproctology G B Irel.* 2010;12(1):5-15<sup>288</sup>.

**78. Patients with associated pulmonary pathology may benefit from epidural analgesia.**

Although there are few randomised clinical trials that study the differences between the application of the epidural catheter at thoracic level or at lumbar level, the existing studies clearly indicate the improved analgesic quality, the smaller number of complications and lower limb blockage in patients on whom a thoracic epidural catheter is carried out, compared to those patients on whom a lumbar level catheter is applied.

**Weak recommendation +. Moderate Level of Evidence.**

- Hong J-Y, Lee SJ, Rha KH, Roh GU, Kwon SY, Kil HK. Effects of thoracic epidural analgesia combined with general anesthesia on intraoperative ventilation/oxygenation and postoperative pulmonary complications in robot-assisted laparoscopic radical prostatectomy. *J Endourol Soc* 2009;23(11):1843–9<sup>289</sup>.

**79. In all other cases, the analgesic strategy must be chosen individually, trying to avoid the use of opiates and favouring the use of transversus plane blockade of the abdomen, spinal analgesia or infiltration of ports with local anaesthetics.**

**Strong recommendation +. Moderate Level of Evidence.**

- Turunen P, Carpelan-Holmström M, Kairaluoma P, Wikström H, Kruuna O, Pere P, et al. Epidural analgesia diminished pain but did not otherwise improve enhanced recovery after laparoscopic sigmoidectomy: a prospective randomized study. *Surg Endosc.* 2009; 23(1):31-7<sup>290</sup>.
- Joshi GP, Bonnet F, Kehlet H, PROSPECT collaboration. Evidence-based postoperative pain management after laparoscopic colorectal surgery. *Colorectal Dis Off J Assoc Coloproctology G B Irel* 2013;15(2):146-55<sup>291</sup>.

Although there are few randomised clinical trials that study the differences between the application of the epidural catheter at thoracic level or at lumbar level, the existing studies clearly indicate the improved analgesic quality, the smaller number of complications and lower limb blockage in patients on whom a thoracic epidural catheter is carried out, compared to those patients on whom a lumbar level catheter is applied. These data are also guaranteed by prospective observational



studies. Further to the above, the majority of studies that support the use of epidural catheterism for analgesia in major abdominal surgery use thoracic puncture points to carry it out.

#### 80. The catheterisation of the epidural space for infusion of local anaesthetics for analgesia in major abdominal surgery must be carried out at thoracic level.

##### **Strong recommendation +. High Level of Evidence.**

- Scott AM, Starling JR, Ruscher AE, DeLessio ST, Harms BA, Michelassi F, et al. Thoracic versus lumbar epidural anesthesia's effect on pain control and ileus resolution after restorative proctocolectomy. *Surgery* 1996;120(4):688-97<sup>292</sup>.
- Pöpping DM, Zahn PK, Van Aken HK, Dasch B, Boche R, Pogatzki-Zahn EM. Effectiveness and safety of postoperative pain management: A survey of 18 925 consecutive patients between 1998 and 2006 (2nd revision): A database analysis of prospectively raised data. *Br J Anaesth* 2008;101(6):832-40<sup>293</sup>.

The supply of small amounts of opiates, together with local anaesthetics that are applied by epidural pathway improves the analgesic quality of the blockade to be carried out, almost without causing a significant increase in the complications on the patient. This effect is independent from the puncture point chosen to carry out the epidural catheterisation.

#### 81. Small doses of opiates must be added to the local anaesthetic doses that are going to be supplied by epidural pathway.

##### **Strong recommendation +. Moderate Level of Evidence.**

- Niemi G, Breivik H. Epidural fentanyl markedly improves thoracic epidural analgesia in a lowdose infusion of bupivacaine, adrenaline and fentanyl. A randomized, double-blind crossover study with and without fentanyl. *Acta Anaesthesiol Scand* 2001;45(2):221-32<sup>294</sup>.

### REGIONAL BLOCKS

Transversus plane blocks have not proven to be superior to the epidural in any RCT, and there is limited clinical evidence about whether the use of transversus plane blocks will obtain a decrease in consumption of intra-operative opiates. However, those patients on whom the implementation of epidural analgesia is contraindicated or is controversial, as is the case of laparoscopic surgery, could benefit from the block.

#### 82. The execution of a bilateral transversus plane block with local anaesthetics could benefit patients who require major abdominal surgery and who cannot benefit from epidural analgesia.

##### **Strong recommendation +. Moderate Level of Evidence.**

- Walter CJ, Maxwell-Armstrong C, Pinkney TD, Conaghan PJ, Bedford N, Gornall CB, et al. A randomised controlled trial of the efficacy of ultrasound-guided transversus abdominis plane (TAP) block in laparoscopic colorectal surgery. *Surg Endosc Interv Tech* 2013;27(7):2366-72<sup>295</sup>.
- Ripollés Melchor J, Marmaña Mezquita S, Abad Gurumeta A, Alvo Vecino JM. Eficacia analgésica del bloqueo del plano transversal del abdomen ecoguiado-revisión sistemática. *Rev Bras Anestesiol* 2014. <http://dx.doi.org/10.1016/j.bjanes.2013.10.015><sup>296</sup>.

83. Abdominal rectus muscle fascia blocks have not proven to be superior to epidural block in any randomised clinical trial. Its execution could benefit patients undergoing major abdominal surgery who cannot benefit from epidural analgesia.

**Strong recommendation +. Moderate Level of Evidence.**

- Ventham NT, Hughes M, O'Neill S, Johns N, Brady RR, Wigmore SJ. Systematic review and meta-analysis of continuous local anaesthetic wound infiltration versus epidural analgesia for postoperative pain following abdominal surgery. *Br J Surg* 2013;100(10):1280-9<sup>297</sup>.

## INTRAVENOUS ANALGESIA

The use of NSAIDs to control pain as coadjutant therapy is associated with a decrease in the consumption of opioids and an improvement of the patient's comfort. Furthermore, the use of NSAIDs could be on equal footing in terms of analgesic power with the infiltration with local anaesthetics of the laparoscopic instrument port insertion points, and selective inhibitors of cyclooxygenase-2 could have some influence on achieving an improvement in the postoperative bowel function.

84. Non-steroid anti-inflammatories (NSAIDs) must be used as coadjutant therapy to control pain in patients who have undergone major abdominal surgery.

**Strong recommendation +. High Level of Evidence.**

- Shaker EH. Comparative study between intraperitoneal administration of either a local anaesthetic or a non-steroidal anti-inflammatory drug for analgesia after laparoscopic surgeries. *Egypt J Anaesth* 2008;24(2):129-37<sup>298</sup>.
- Wattchow DA, De Fontgalland D, Bampton PA, Leach PL, McLaughlin K, Costa M. Clinical trial: the impact of cyclooxygenase inhibitors on gastrointestinal recovery after major surgery -a randomized double blind controlled trial of celecoxib or diclofenac vs. placebo. *Aliment Pharmacol Ther* 2009;30(10):987-98<sup>299</sup>.

## INTRAVENOUS ANALGESIC COADJUTANTS

Ketamine could reduce the inflammatory reaction that follows the surgical act, reducing the levels of IL-6. In addition, it could also play an important role to prevent hyperalgesia situations in patients with intraoperative therapy with remifentanyl. When small amounts of post-surgical intravenous ketamine are added in patients treated with major opiates, the requirement and consumption of opiates decreases without causing a significant increase in the side effects, although this effect has not proven to be effective when supplied as treatment prior to the surgery.

85. Intravenous ketamine must be supplied in patients treated with major opiates for analgesia in major abdominal surgery.

**Strong recommendation +. High Level of Evidence.**

- Dale O, Somogyi AA, Li Y, Sullivan T, Shavit Y. Does intraoperative ketamine attenuate inflammatory reactivity following surgery? A systematic review and meta-analysis. *Anesth Analg* 2012;115(4):934-43<sup>300</sup>.
- Laskowski K, Stirling A, McKay WP, Lim HJ. A systematic review of intravenous ketamine for postoperative analgesia. *J Can Anesth* 2011;58(10):911-23<sup>301</sup>.

Magnesium sulphate has been postulated as effective analgesic coadjutant.

**86. The use of intraoperative intravenous magnesium sulphate as an analgesia coadjutant could improve the control of pain in patients undergoing abdominal surgery.**

**Strong recommendation +. Moderate Level of Evidence.**

- Usmani H, Quadir A, Alam M, Rohtagi A, Ahmed G. Evaluation of perioperative Magnesium Sulphate infusion on postoperative pain and analgesic requirements in patients undergoing upper abdominal surgery? *J Anaesthesiol Clin Pharmacol* 2007;23(3):255–8<sup>302</sup>.

**ORAL ANALGESIC COADJUTANTS**

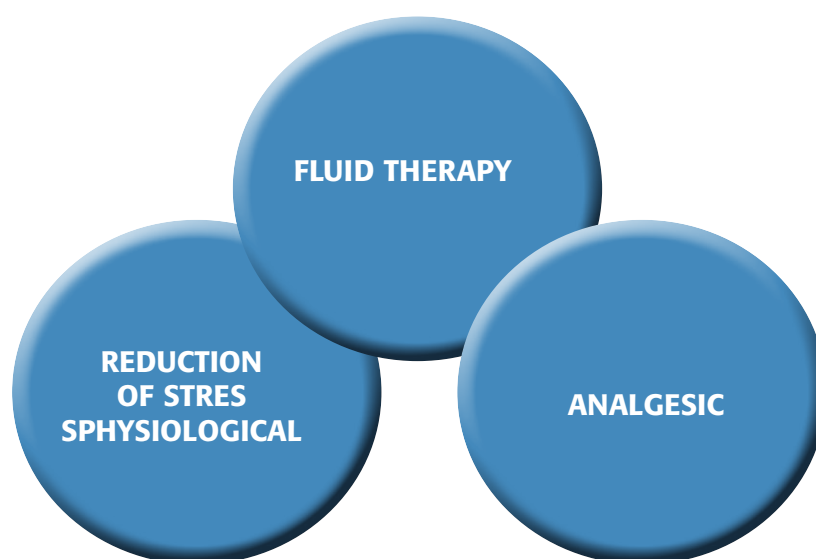
The administration of neuroleptics could produce a significant decrease in the use of opioids during the first 24 hours in patients who have been provided with a preoperative dose of gabapentin or pregabalin by oral pathway, without causing them any side effects. Moreover, it could have a beneficial effect on patient's chronic pain after 6 months.

Patients over the age of 65 present more side effects derived from the use of pregabalin and they could be subsidiaries for the use of gabapentin.

**87. All patients who require major abdominal surgery should receive a preoperative dose of gabapentin or pregabalin by oral pathway before surgery.**

**Strong recommendation +. High Level of Evidence.**

- Behdad S, Ayatollahi V, Bafghi AT, Tezerjani MD, Abrishamkar M. Effect of gabapentin on postoperative pain and operation complications: a randomized placebo controlled trial. *West Indian Med J* 2012;61(2):128–33<sup>303</sup>.
- Fassoulaki A, Melemenis A, Tsaroucha A, Paraskeva A. Perioperative pregabalin for acute and chronic pain after abdominal hysterectomy or myomectomy: a randomised controlled trial. *Eur J Anaesthesiol* 2012;29(11):531–6<sup>304</sup>.
- Turan A, Karamanlioğlu B, Memiş D, Usar P, Pamukçu Z, Türe M. The analgesic effects of gabapentin after total abdominal hysterectomy. *Anesth Analg* 2004;98(5):1370–73<sup>305</sup>.



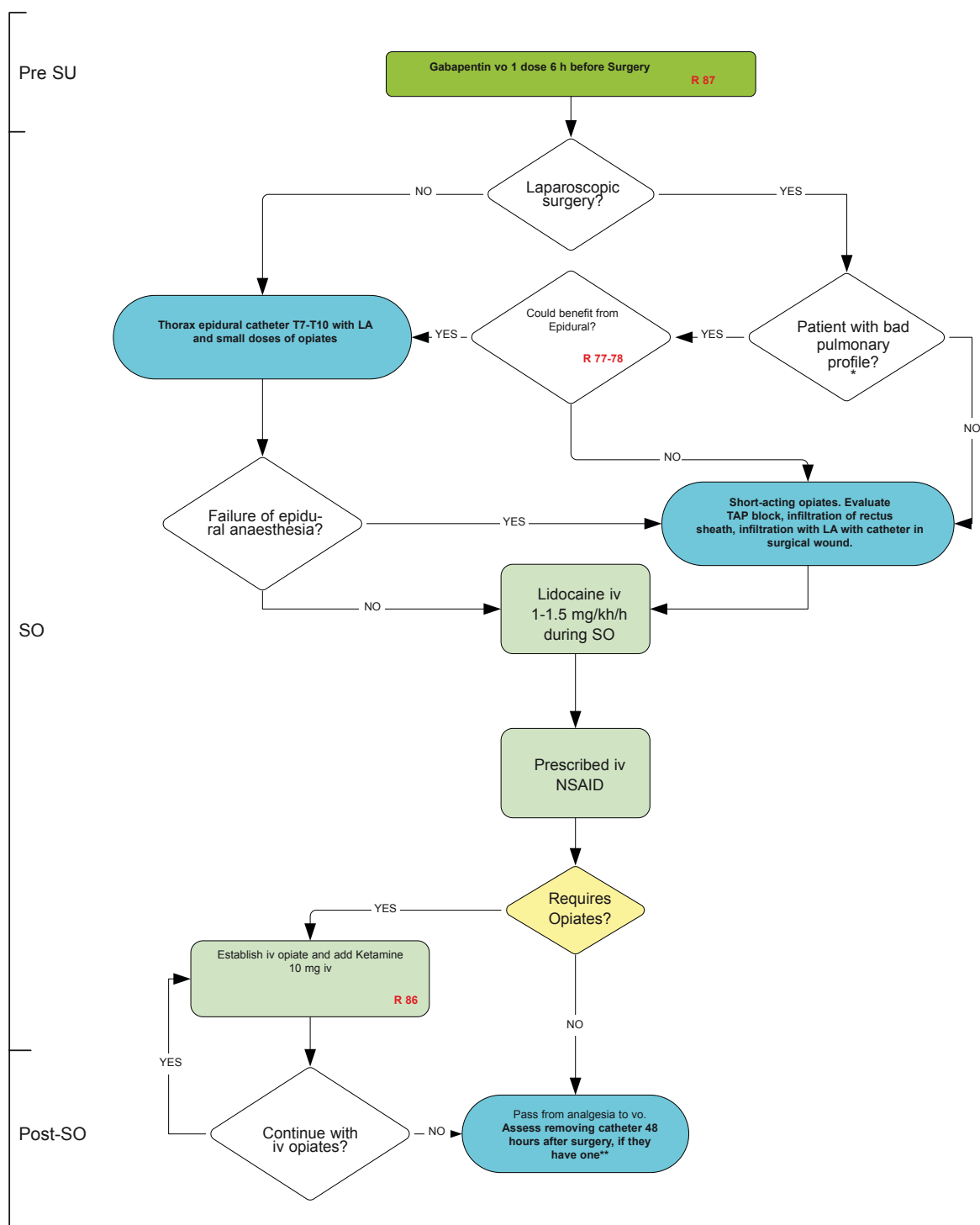
(Other studies of interest on this section.<sup>300, 306-319</sup>)



# **Intraoperative anaesthetic trimodal approach**

Figure 5.

## **Analgesia management algorithm**



Recommendations on management of Analgesia:  
From R 67 to R 87

\*: Criteria of bad pulmonary f(x)  
\*\*: Criteria of catheter maintenance  
LA: Local anaesthetics

## PERIOPERATIVE HYPERGLYCAEMIA

The glucidic metabolism is strongly altered through inflammation, sepsis or hypoxia. Hyperglycaemia observed in acute pathological situations is called "stress diabetes". This starts with acute secretion of contraregulating hormones and inflammatory mediators, which is prolonged due to insulin-resistance and a drop in pancreatic insulin secretion. Insulin-resistance mainly affects three organs, the liver, skeletal muscle and adipose tissue. This is globally translated into a higher insulin concentration to control a normal glycaemia level. At hepatic level, the production of glucose via neoglucogenesis and glucogenolysis increases. In the muscle and fat compartment, insulin-resistance is translated into a low use of circulating glucose and low penetration of glucose in more insulin-dependent tissues. Thus, the global result entails hyperglycaemia with penetration of glucose in non-insulin-dependent tissues, such as immune, inflammatory cells and lesioned tissues. Insulin-resistance, the main cause of perioperative hyperglycaemia, appears after the first hours following the operation and may last for up to two or three weeks after the postoperative period.

Hypothermia, blood losses and intense surgical aggression emphasise perioperative insulin-resistance. One of the objectives of early rehabilitation is to control perioperative hyperglycaemia. This insulin-resistance induced hyperglycaemia can be improved with an intake of exogenous insulin during this period. The final result of maintaining normoglycaemia is positive throughout the postoperative period.

### 88. Glycaemia levels of over 180 mg/dl should be avoided during surgery in patients at risk of developing insulin-resistance (obese, elderly, long surgical duration).

#### **Strong recommendation +. Moderate Level of Evidence.**

- Société française d'anesthésie et de réanimation (Sfar), Société de réanimation de langue française (SRLF). [Formal recommendations by the experts. Glycemic control in intensive care unit and during anaesthesia. Société française d'anesthésie et de réanimation. Société de réanimation de langue française]. Ann Fr Anesth Reanim 2009;28(4):410–5<sup>320</sup>.
- Smith A, Kranke P, Murat I et al. Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology. Eur J Anaesthesiol 2011;28:556-69<sup>321</sup>.

### 89. A strict glycaemic control should be carried out after the surgical operation, maintaining a level of below 110 mg/dl.

#### **Strong recommendation +. High Level of Evidence.**

- Lipshutz AKM, Gropper MA. Perioperative glycemic control: an evidence-based review. Anesthesiology 2009;110(2):408–21<sup>322</sup>.

### 90. The objective of post-surgical hyperglycaemia treatment in diabetic patients is not formally defined. However, values of under 110 mg/dl or over 150 mg/dl seem to be harmful and should be avoided.

#### **Strong recommendation +. Moderate Level of Evidence.**

- Société française d'anesthésie et de réanimation (Sfar), Société de réanimation de langue française (SRLF). [Formal recommendations by the experts. Glycemic control in intensive care unit and during anaesthesia. Société française d'anesthésie et de réanimation. Société de réanimation de langue française]. Ann Fr Anesth Reanim 2009;28(4):410–5<sup>322</sup>.

(Other studies of interest on this section<sup>323-328</sup>)

## DRAINAGES

Drainages are used to discharge possible collections in the surgery bed. Their use may cause discomfort for the patient and make mobilisation difficult. There is evidence that their use does not provide any advantage other than peritoneal reflection. Their use during the first 24 hours after pelvic surgery may be useful.

### 91. The use of drainage is not recommended, with the exception of pelvic surgery.

#### Strong recommendation -. High Level of Evidence.

- Mutter D, Panis Y, Escat J. Drainage in digestive surgery. French Society of Digestive Surgery. J Chir 1999;136:117-23<sup>329</sup>.

## IV. POSTOPERATIVE PROCEDURE

### POSTOPERATIVE PROCEDURE IN THE POST-ANAESTHESIA RECOVERY UNIT (PARU)

The management and control of Enhanced Recovery for Abdominal Surgery patients in the PARU by nursing staff must adapt to acknowledged standards for all patients according to the surgical procedure and the type of anaesthesia used. Monitoring vital signs, level of consciousness, respiratory pattern, control of blood volume, early detection of bleeding signs, management of catheters and/or drainages and early mobilisation are just some of their actions. In those cases where the patient has no bladder catheter, urinary elimination must be supervised, detecting the appearance of bladder balloon early on<sup>330</sup>.

Maintaining normothermia and treating nausea and vomiting, administering the prescribed treatment are some of the actions in PARU.

### PAIN

Evaluating postoperative pain is one of the competences of the nursing staff who attend patients in the immediate postoperative period in the post-anaesthesia recovery unit (PARU). Using a visual analogue scale (VAS) is extremely helpful when administering the prescribed analgesic, achieving them some acceptable pain levels with them (moderate 0-4)<sup>331</sup>.

### POSTOPERATIVE PROCEDURE IN HOSPITALISATION UNIT

Patient-controlled analgesia is a useful option in the management of postoperative procedure pain.

- Hudcova J, McNicol ED, Quah CS, Lau J, Carr DB. Patient controlled opioid analgesia versus conventional opioid analgesia for postoperative pain. Cochrane Database of Systematic Reviews 2006; Issue 4 N°:CD003348. DOI:10.1002/14651858.CD003348.pub2.<sup>332</sup>

### EARLY FEEDING

Maintaining patients on absolute diet used to be a normal measure in the postoperative procedure, and its aim was to avoid postoperative nausea and vomiting, reducing the effect of paralytic ileus and prevent anastomotic leaks. Thus, tolerance to liquids began after the appearance of bowel sounds and elimination of gases and/or faeces. Enhanced recovery models propose the start of early oral feeding rather than the traditional concept of postoperative absolute diet.

## 92. Early feeding within the first 24 postoperative hours is recommended.

### Strong recommendation +. High Level of Evidence.

- Dag A, Colak T, Turkmenoglu O, et al. A randomized controlled trial evaluating early versus traditional oral feeding after colorectal surgery. *Clinics (Sao Paulo)* 2011;66(12):2001-5<sup>333</sup>.
- Lobato Dias Consoli M, Maciel Fonseca L, Gomesda Silva R, et al. Early postoperative oral feeding impacts positively in patients undergoing colonic resection: results of a pilot study. *Nutr Hosp* 2010;25(5):806-9<sup>334</sup>.
- Reissman P, Teoh TA, Cohen SM, Weiss EG, Nogueras JJ, Wexner SD. Is early oral feeding safe after elective colorectal surgery? A prospective randomized trial. *Ann Surg* 1995; 222:73-7<sup>335</sup>.
- Carr CS, Ling KDE, Boulos P, et al. Randomized trial of safety and efficacy of immediate postoperative enteral feeding in patients undergoing gastrointestinal resection. *BMJ* 1996;312:866-71<sup>336</sup>.
- Lassen K, Soop M, Nygren J, et al; Enhanced Recovery After Surgery (ERAS) Group. Consensus review of optimal perioperative care in colorectal surgery: Enhanced Recovery After Surgery (ERAS) Group recommendations. *Arch Surg* 2009;144:961-9<sup>337</sup>.
- Wang G, Jiang ZW, Xu J, et al. Fast-track rehabilitation program vs conventional care after colorectal resection: a randomized clinical trial. *World J Gastroenterol* 2011;17:671-6<sup>338</sup>.
- Andersen HK, Lewis SJ, Thomas S. Early enteral nutrition within 24 h of colorectal surgery versus later commencement of feeding for postoperative complications. *Cochrane Database Syst Rev* 2006;(4):CD004080 10.1002/14651858.CD004080.pub2<sup>339</sup>.
- Lewis SJ, Egger M, Sylvester PA. Early enteral feeding versus nil by mouth after gastrointestinal surgery; systemic review and metaanalysis of controlled trials. *BMJ* 2001;323:1-5<sup>340</sup>.
- Delaney CP, Zutshi M, Senagore AJ, Remzi FH, Hammel J, Fazio VW. Prospective, randomized, controlled trial between a pathway of controlled rehabilitation with early ambulation and diet and traditional postoperative care after laparotomy and intestinal resection. *Dis Colon Rectum* 2003;46:851-9<sup>341</sup>.
- Soop M, Carlson GL, Hopkinson J, et al. Randomized clinical trial of the effects of immediate enteral nutrition on metabolic responses to major colorectal surgery in an enhanced recovery protocol. *Br J Surg* 2004;91:1138-45<sup>342</sup>.
- Watters JM, Kirkpatrick SM, Norris SB, Shamji FM, Wells GA. Immediate postoperative enteral feeding results in impaired respiratory mechanics and decreased mobility. *Ann Surg* 1997;226:369-77.<sup>343</sup>

## EARLY MOBILISATION

Resting in bed increases insulin-resistance. In addition it produces the loss of muscle mass and strength, reducing the pulmonary function and cell oxygenation. Early mobilisation has been related to the reduction in the appearance of pressure ulcers, deep-vein thrombosis and pneumonia. Early mobilisation leads to the obvious reduction of pulmonary complications. Despite evidence in this regard, early mobilisation is not normal practice in abdominal surgery postoperative procedure. Early mobilisation obviously entails an adequate control of postoperative pain and a limitation in the use of catheters and drainages.

It is advisable for the patient to be out of bed for two hours the same day as the surgery and at least six hours a day on the following days, until hospital discharge.

### 93. Mobilisation during the first 24 post-surgery hours is recommended

#### **Strong recommendation +. High Level of Evidence.**

- Henriksen MG, et al., Enforced mobilization, early oral feeding, and balanced analgesia improve convalescence after colorectal surgery. *Nutrition* 2002;18(2):147-52<sup>344</sup>.
- Houborg KB, et al. Postoperative physical training following colorectal surgery: a randomised, placebo-controlled study. *Scand J Surg* 2006;95(1):17-22<sup>345</sup>.

### RESPIRATORY PHYSIOTHERAPY

Carrying out respiratory exercises in the preoperative period leads to a reduction in respiratory complications in the postoperative period. Carrying out deep respiratory exercises and incentivised spirometry, together with exercises aimed at increasing the strength of the inspiratory muscles, are some of the methods used. On the contrary, maintained deep inspiration exercises carried out both during the preoperative and the postoperative periods in patients with abdominal surgery are not related to the appearance of a smaller number of postoperative pulmonary complications.

Incentivised spirometry has not proved to be beneficial in preventing complications in the abdominal surgery postoperative period. It must be used combined with other methods and deep respiratory exercises, directed cough and early mobilisation.

### 94. The execution of preoperative and postoperative respiratory physiotherapy is recommended

#### **Strong recommendation +. High Level of Evidence.**

- Soares SM, Nucci LB, da Silva MM, Campacci TC. Pulmonary function and physical performance outcomes with preoperative physical therapy in upper abdominal surgery: a randomized controlled trial. *Clin Rehabil* 2013;27(7):616-27<sup>346</sup>.
- Duggan M, Kavanagh BP. Perioperative modifications of respiratory function. *Best Pract Res Clin Anaesthesiol* 2010; 24(2):145-55<sup>347</sup>.
- Westwood K, Griffin M, Roberts K, Williams M, Yoong K, Digger T. Incentive spirometry decreases respiratory complications following major abdominal surgery. *Surgeon* 2007;5(6):339-42<sup>348</sup>.
- Pouwels S, Stokmans RA, Willigendael EM, Nienhuijs SW, Rosman C, van Ramshorst B, et al. Preoperative exercise therapy for elective major abdominal surgery: A systematic review. *Int J Surg* 2013; (13):1118-1127<sup>349</sup>.
- Ferreyra G, Long Y, Ranieri VM. Respiratory complications after major surgery. *Curr Opin Crit Care* 2009;15(4):342-8<sup>350</sup>.
- Mackay MR, Ellis E, Johnston C. Randomised clinical trial of physiotherapy after open abdominal surgery in high risk patients. *Aust J Physiother* 2005;51(3):151-9<sup>351</sup>.

### RECOMMENDATIONS ON DISCHARGE

The discharge of patients must be planned and each patient's instructions about their care must be personalised, especially in elderly patients. When patients are discharged, understanding the care they must receive and the control they will be submitted to must be guaranteed. The use of standardised informative documents improves the patients' understanding of the information received on discharge.

Patients must be discharged with the appointments for their control including those that correspond to other services.

Personalised recommendations on discharge influence the average stay and re-admissions. However, the influence of the recommendations on discharge on mortality, health results and costs is unknown.

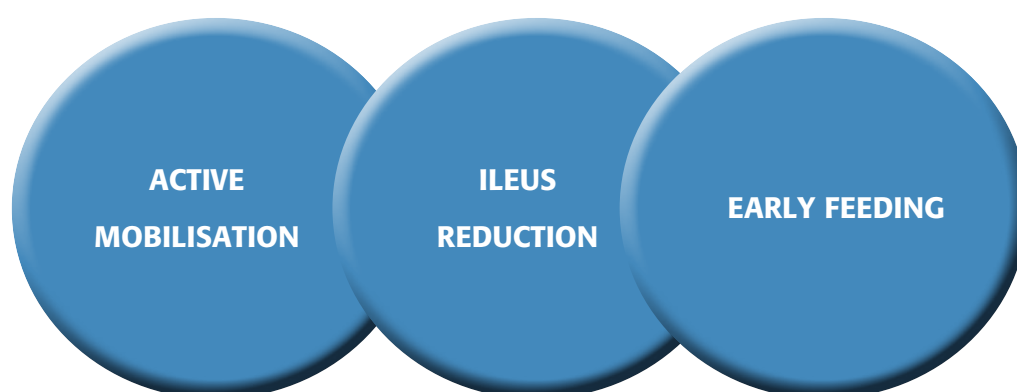
Appropriate, understandable and complete information on discharge improves patients' satisfaction. Delays in discharge, due to teaching how to manage the stomas, are considerably reduced if instructions have been given prior to the operation and during admission.

Support therapy on discharge is recommended: physiotherapy or physical exercise, care of stomas and dietetics. Telephone control is also recommended during the first 2 hours. Prolonging telephone control may be important for some pathologies.

**95. Patients and their caregivers must receive personalised, understandable and complete information when discharged. Planning the discharge and adequately informing about care after discharge influences the average stay and re-admissions.**

**Strong recommendation +. High Level of Evidence.**

- Shepperd S1, McClaran J, Phillips CO, Lannin NA, Clemson LM, McCluskey A, Cameron ID, Barras SL. Discharge planning from hospital to home. Cochrane Database Syst Rev 2013; 1:CD000313<sup>352</sup>.
- Younis J1, Salerno G, Fanto D, Hadjipavlou M, Chellar D, Trickett JP. Focused preoperative patients to maeducation, prior to ileostomy formation after anterior resection, contributes to a reduction in delayed discharge within the enhanced recovery programme. Int J ColorectalDis 2012;27(1):43-7<sup>353</sup>.



# Key points

## SUMMARY TABLE OF RECOMMENDATIONS

	RECOMMENDATION	DEGREE OF RECOMMENDATION	LEVEL OF EVIDENCE
PREOPERATIVE OPTIMISATION			
INFORMATION FOR THE PATIENT			
1	Patients must receive complete oral and written information regarding what they are requested to do in order to improve recovery after surgery.	Strong +	Moderate
EVALUATION OF THE ANAESTHETIC-SURGICAL RISK			
Assessment of the cardiological risk			
2	Patients with new onset or decompensated active cardiac pathology must be assessed by cardiologists prior to the operation.	Strong +	High
Assessment of nutritional state. <i>Figure 1 – Nutritional assessment algorithm</i>			
3	Nutritional screening is recommended on all patients who are going to undergo major surgery.	Strong +	Moderate
4	When a patient at risk of malnutrition is identified, a complete nutritional evaluation must be carried out, establishing a nutritional treatment plan, monitoring tolerance and response to this plan. Some laboratory determinations may inform of the degree of inflammation associated with the disease (albumin, C-Reactive protein, etc.) and of possible nutrient deficiencies (vitamins, minerals), permitting a better syndrome classification of the patient's malnutrition.	Strong +	Moderate
Assessment of Diabetes Mellitus			
5	Control of hyperglycaemia is essential and it must be performed by an Endocrinology service in case of bad glycaemia control and by Primary Care.	Weak +	Moderate
6	Preoperative determination of HbA1c is suggested.	Weak +	Low
Assessment of preoperative anaemia <i>Figure 2. Algorithm of preoperative management of anaemic patient</i>			
7	Detecting preoperative anaemia is recommended, as it is associated with an increase of perioperative mortality.	Strong +	High



	RECOMMENDATION	DEGREE OF RECOMMENDATION	LEVEL OF EVIDENCE
8	Determining Hb in patients undergoing elective surgery is recommended at least 28 days prior to surgery, as this gives sufficient time for erythropoiesis stimulation, if necessary.	Strong +	Moderate
9	It is suggested that the level of preoperative Hb prior to surgery should be within the normality margins identified by the WHO (men Hb $\geq 13\text{g/dl}$ ; women $\geq 12\text{g/dl}$ ).	Weak +	Moderate
10	Treatment with oral iron is suggested in anaemic patients, for 14 days prior to surgery with 200 mg/day of ferric sulphate; to increase preoperative Hb and decrease MBP in patients with colorectal cancer.	Strong +	Moderate
11	Treatment with intravenous iron is suggested in anaemic patients who are going to require gynaecological and colorectal surgery to increase preoperative Hb and reduce MBP.	Strong +	Moderate
12	The use of intravenous iron, instead of oral iron, is suggested in those cases where the latter is contraindicated or there is insufficient time.	Strong +	Moderate
13	The use of gonadotropin-releasing hormone agonists (GnRHa) is suggested for the preoperative treatment of haemorrhage-derived anaemia faced with the existence of uterine fibroids.	Strong +	High
<b>PREOPERATIVE FASTING AND TREATMENT WITH CARBOHYDRATE DRINKS</b>			
14	Fasting will be limited to 6 hours for solids and 2 hours for liquids, even for obese and diabetic patients as it has been amply demonstrated that fasting of more than eight hours does not provide any benefit.	Strong +	High
15	The regular administration of carbohydrate drinks (200-300 cc) with 12.5% maltodextrins is recommended two hours before surgery, as this reduces anxiety and insulin resistance.	Strong +	High
16	Measures will be taken in patients with prolonged gastric clearance in order to prevent regurgitation during anaesthetic induction.	Strong +	High
17	Offering a carbohydrate drink to type 2 diabetes patients may be considered before surgery. This can be administered together with their antidiabetes medication.	Weak +	Low
<b>RECOMMENDATIONS FOR THE PATIENT</b>			
<b>Tobacco and Alcohol</b>			
18	Smoking must be stopped one month prior to the surgery, as its consumption increases the risk of pulmonary complications by 50%; and the same with alcohol consumption as it gives rise to further complications.	Strong +	High
<b>"Prehabilitation"</b>			
19	Doing preoperative prehabilitation exercises is suggested in order to improve functional capacity.	Weak +	Moderate
<b>Hygiene and preparation of the skin for surgery</b>			
20	Having a full bath prior to surgery is recommended.	Strong +	High



	RECOMMENDATION	DEGREE OF RECOMMENDATION	LEVEL OF EVIDENCE
	<b>Hair removal</b>		
21	Whenever hair removal is necessary, the use of electric shavers is recommended.	Strong +	Moderate
<b>IMMEDIATE PREOPERATIVE PROCEDURE</b>			
	<b>BOWEL PREPARATION</b>		
22	Mechanical preparation of the colon is not recommended with the exception of those rectal surgery cases where there are possibilities of protection stoma.	Strong -	High
23	No bowel preparation could contribute to faster recovery from bowel peristalsis and a shorter hospital stay	Strong +	Moderate
	<b>THROMOPROPHYLAXIS</b>		
24	Compression stockings are effective to prevent thromboembolic disease in surgical patients, further reducing the risk if combined with pharmacological agents.	Strong +	High
25	Intermittent pneumatic compression devices decrease the prevalence of deep vein thrombosis and the combined method with pharmacological measures is more effective.	Strong +	High
26	Unfractionated heparin (UFH) and low molecular weight heparins (LMWH) are equally effective in preventing deep vein thrombosis and pulmonary thromboembolism.	Strong +	High
	<b>ANTIBIOTIC PROPHYLAXIS</b>		
27	Routine prophylaxis with intravenous antibiotics is recommended between 30 and 60 minutes before the surgical incision (or in the theatre). Repeating the dose is advised in prolonged procedures in agreement with the average life of the drugs.	Strong +	High
	<b>Management of preoperative anxiety</b>		
28	The preoperative visit of theatre nurses is recommended to decrease anxiety.	Strong +	Low
	<b>PREMEDICATION</b>		
	<b>Sedatives</b>		
29	Short-acting anxiolytics may interfere in starting to recover mobility and the ability to intake food, although they do not affect the duration of the hospital stay, so they can be used to facilitate regional anaesthesia techniques when these are indicated.	Weak +	Low
	<b>Glucocorticoids</b>		
30	The administration of one single dose of glucocorticoids may have a significant impact on the duration of the hospital stay without increasing the complication rate.	Strong +	High
<b>INTRAOPERATIVE PROCEDURE</b>			
	<b>ROUTINE MONITORING</b>		
31	Monitoring CO <sub>2</sub> by capnography must be compulsory in any surgery, especially in laparoscopes, as any modification in the telespiratory pressure curve of CO <sub>2</sub> may be a sign of intraoperative complications.	Strong +	High

	RECOMMENDATION	DEGREE OF RECOMMENDATION	LEVEL OF EVIDENCE
32	Monitoring temperature must be central.	Strong +	High
33	Anaesthetic depth will be monitored by bispectral index (BSI).	Strong +	High
34	The use of objective monitoring (neurostimulation with accelerometry, mechanomyography, electromyography, kinemyography) of the NMB is necessary, with simple stimulus parameters, post-tetanic count, TOF and TOF ratio during the use of NMB to permanently know the degree of NMB.	Strong +	High
35	Glycaemia will be monitored, given that intraoperative hyperglycaemia may give rise to an increase in complications in the postoperative procedure, although the use of intensive therapy with insulin must be avoided, due to the risk of hypoglycaemia.	Strong +	High
36	When bladder catheter is fitted, this will be done with the appropriate asepsis measures, and it will be removed 24 hours after surgery, or 48 hours after surgery at the latest.	Weak +	Moderate
<b>NON-ROUTINE MONITORING</b>			
37	Invasive monitoring is not indicated as a routine, but invasive artery channelling is useful in selected patients. Especially indicated in those patients who have severe cardiorespiratory alterations and who may have problems during postoperative procedure.	Strong -	Low
38	The insertion of CVC is not indicated as a routine. It will be considered in selected cases. The use of central venous catheter is limited to patients with respiratory diseases in whom the administration of vasopressors or inotropes in continuous perfusion may be foreseen as necessary.	Strong -	Low
<b>Preparation of the skin and surgical site</b>			
39	The skin must be disinfected before defining the surgical site. This must be done in circles, from clean to dirty.	Strong +	High
40	The use of chlorhexidine in 1% alcohol solution is recommended as an antiseptic for the skin of the surgical site.	Strong +	High
<b>Anaesthetic induction and maintenance</b>			
41	The use of short-acting anaesthetic agents is recommended in induction and maintenance, thus permitting rapid awakening.	Strong +	Low
42	Anaesthesia induction and maintenance may be guided by the bispectral index (BIS) monitor, thus avoiding excessively deep levels of hypnosis (BIS<30), especially in the elderly, in whom there is evidence that, if the anaesthesia is too deep, this may be harmful and may increase the risk of postoperative confusion.	Strong +	High
<b>Surgical approach and incisions</b>			
43	The use of laparoscopic technique is recommended if there is experience.	Strong +	High
44	If open surgery is performed, the use of transverse, low location incisions whenever possible, is accompanied by less postoperative pain and pulmonary complications, and there is clear evidence of its advantage over other types of incisions. If the use of transverse incisions is not possible, a midline incision will be made, trying to keep it as small as possible.	Strong +	Moderate

	RECOMMENDATION	DEGREE OF RECOMMENDATION	LEVEL OF EVIDENCE
<b>Intraoperative inspired oxygen fraction (FiO2)</b>			
45	The intraoperative administration of high oxygen concentrations (at least FiO2: 50%) is a supplementary strategy that decreases the risk of infection of the surgical wound in patients who require abdominal surgery and who receive antibiotic prophylaxis.	Strong +	High
46	High inspired oxygen fraction reduces the risk of postoperative nausea and vomiting, most especially in patients who receive inhaled anaesthetics without antiemetic prophylaxis.	Strong +	High
47	A high oxygen concentration does not increase the prevalence of postoperative atelectasis.	Strong +	High
<b>Intraoperative normothermia</b>			
48	Avoiding intraoperative hypothermia in abdominal surgery is recommended.	Strong +	High
<b>Postoperative nausea and vomiting prophylaxis</b>			
49	The risk of PONV must be stratified in all patients via the Apfel scale, performing prophylaxis according to the result.	Strong +	High
50	The use of propofol for anaesthesia induction and maintenance is recommended in patients with a high risk of PONV.	Strong +	High
51	Avoiding the use of nitrous oxide is recommended in patients with high risk of PONV.	Strong +	High
52	Avoiding the use of inhaled anaesthetics is recommended in patients with high risk of PONV.	Strong +	High
53	Minimising the risk of intraoperative and postoperative opioids is recommended.	Strong +	High
54	In patients with low risk of PONV, prophylaxis is not indicated in all patients, except in high risk surgery, including laparoscopy, laparotomy, urological, breast, plastic and maxillofacial surgery, in which case prophylaxis will be carried out with pharmacological monotherapy by means of dexamethasone in anaesthesia induction or droperidol when surgery ends.	Strong -	High
55	Measures are indicated to decrease basal risks in patients with moderate risk of PONV, as well as dual pharmacological therapy with dexamethasone and droperidol or ondansetron.	Strong +	High
56	Measures are indicated to reduce basal risks in patients with high risk of PONV, as well as pharmacological prophylaxis with triple therapy by means of dexamethasone, droperidol and ondansetron. Administering the latter when surgery ends.	Strong +	High
57	The administration of combined therapy is preferable to monotherapy in moderate to high risk patients	Strong +	High
58	In those cases where PONV appears, treatment must be started with an antiemetic of a different family to that used for the prophylaxis; if no prophylaxis has been carried out, the use of low doses of ondansetron is recommended.	Strong +	High

	RECOMMENDATION	DEGREE OF RECOMMENDATION	LEVEL OF EVIDENCE
	<b>Routine use of nasogastric tube for prophylactic purposes</b>		
59	The use of nasogastric tube is not recommended.	Strong -	High
	<b>Intraoperative fluid therapy</b> <i>Figure 4. Algorithm of goal-directed fluid therapy (GDFT)</i>		
60	The use of SV (Stroke Volume) or of SVV (Stroke Volume Variation) by monitoring is recommended to guide the intra-operative administration of fluids.	Strong +	High
61	The administration of fluids is indicated in those cases where there is a drop in SV > 10% or of SVV > 10%.	Strong +	High
62	Restrictive continuous fluid perfusion must be maintained in order to avoid fluid overload.	Strong +	High
63	Intraoperative hypotension must be treated with vasopressors.	Strong +	High
64	A mean blood pressure range of 70 mmHg must be established.	Strong +	Moderate
65	A CI of > 2.5 l/min/m <sup>2</sup> must be maintained, using inotropes in cases where there is no response to volume.	Strong +	Moderate
66	Monitoring with oesophageic doppler is preferred, or else methods based on validated pulse contour analyses.	Strong +	Moderate
	<b>NEUROMUSCULAR BLOCK AND OPIATE DRUG REVERSAL</b>		
	<b>Neuromuscular block</b>		
67	TOF (train of four) deep neuromuscular block (NMB) = 0, with at least 1 or 2 post-tetanic count responses, or depending on the patient, a moderate block with no more than 1 TOF response, may allow the surgeon to have a better view of the laparoscopic site, so it would be recommendable to maintain this blockade level with NMB in boluses or in continuous perfusion until the end of the operation with pneumoperitoneum, to maintain intra-abdominal pressures < 8-10 cmH <sub>2</sub> O.	Weak +	High
68	The use of objective monitoring (neurostimulation with accelerometry, mechanomyography, electromyography, kinemyography) of the NMB is necessary, with simple stimulus parameters, post-tetanic count, TOF and TOF ratio during the use of NMB to permanently know the degree of NMB.	Strong +	High
	<b>Reversal of the muscle block</b>		
69	A TOF ratio > 0.9 is necessary in anaesthesia reduction, prior to extubation	Strong +	High
70	There is scientific evidence that TOF ratio values < 0.9 entail a greater risk of suffering respiratory complications, hypoxemia and oxygen desaturation during transfer and arrival at reanimation, including the need for re-intubation.	Strong +	High
71	To reach a TOF ratio > 0.9 it is necessary; if starting with deep blockade; reverting with sugammadex, 4 mg/kg, or in the case of moderate blockade, with 1 or 2 responses to TOF of 2 mg/kg in weight, if aminosteroid NMB has been used, such as rocuronium and vecuronium, and extubation must not be carried out until a TOF ratio > 0.9 is reached. When there are less than 3-4 TOF responses, the NMB can be reverted with neostigmine and atropin, and extubation must not be carried out until TOF ratio > 0.9.	Strong +	High

	RECOMMENDATION	DEGREE OF RECOMMENDATION	LEVEL OF EVIDENCE
72	Sugammadex, 2 mg/kg, can be used instead of atropin and neostigmin, when there is residual blockade, with TOF <0.9 or moderate, with 1-3 responses of the TOF, in patients with mitochondrial myopathies, dystrophies and muscular myopathy, myasthenia gravis, history of tachyarrhythmias and ischaemic cardiopathy, in the really elderly, severe malnutrition, chronic bronchitis and asthma, slow metaboliser of NMB, SAOS and morbid obesity.	Strong +	Moderate
73	If benzyl quinoline NMB such as atracurium, cisatracurium or mivacurium is used, reversal must be carried out when there are at least 3-4 responses of TOF, with neostigmine (0.05–0.03 mg/kg) and atropine (0.01 mg/kg), and extubation must not be carried out until TOF ratio > 0.9. Reversal cannot be carried out with sugammadex.	Strong +	High
74	NMB can be used in morbid obesity based on real weight and using sugammadex if rocuronium or vecuronium has been used, to revert based on this real weight. If the NMB is carried out based on corrected weight, sugammadex, as it is pooled in an equimolar manner, must be used based on the same corrected weight.	Weak +	Moderate
<b>Opiate reversal</b>			
75	The use of Naloxone is not recommended to revert the effects of opioids.	Weak -	Low
<b>PERIOPERATIVE ANALGESIA</b>			
<i>Figure 5. Algorithm of analgesia management</i>			
<b>Epidural analgesia</b>			
76	Epidural analgesia must be performed within combined anaesthesia on all patients who undergo open major abdominal surgery procedures.	Strong +	High
77	Epidural catheterisation is not recommended as analgesic method in routine laparoscopic major abdominal surgery	Strong -	High
78	Patients with associated pulmonary pathology may benefit from epidural analgesia.	Weak +	Moderate
79	The analgesia strategy must be personalised, trying to prevent the use of opiates and favouring the use of transversus plane block, spinal analgesia or port infiltration with local anaesthetics, when epidural analgesia is not indicated.	Strong +	Moderate
80	The catheterisation of the epidural space for infusion of local anaesthetics for analgesia in major abdominal surgery must be carried out at thoracic level.	Strong +	High
81	Small doses of opiates must be added to the local anaesthetic doses that are going to be supplied by epidural pathway.	Strong +	Moderate
<b>Regional blocks</b>			
82	The execution of a bilateral transversus plane block with local anaesthetics could benefit patients who require major abdominal surgery and who cannot benefit from epidural analgesia.	Strong +	Moderate
83	The execution of abdominal rectus muscle fascia blocks could benefit patients who undergo major abdominal surgery that cannot benefit from epidural analgesia.	Strong +	Moderate

	RECOMMENDATION	DEGREE OF RECOMMENDATION	LEVEL OF EVIDENCE
	<b>Intravenous analgesia</b>		
84	Non-steroid anti-inflammatory drugs (NSAIDs) must be used as coadjutant therapy to control pain in patients who have undergone major abdominal surgery.	Strong +	High
	<b>Intravenous analgesic coadjutants</b>		
85	Intravenous ketamine must be supplied in patients treated with major opiates for analgesia in major abdominal surgery.	Strong +	High
86	The use of intraoperative intravenous magnesium sulphate as an analgesia coadjutant could improve the control of pain in patients undergoing abdominal surgery.	Strong +	Moderate
	<b>Oral analgesic coadjutants</b>		
87	All patients who require major abdominal surgery should receive a preoperative dose of gabapentin or pregabalin by oral pathway before surgery. Gabapentin is preferred in over 65s	Strong +	High
	<b>PERIOPERATIVE HYPERGLYCAEMIA</b>		
88	During surgery on patients with risk of developing insulin-resistance (obese, elderly, long surgical duration) glycaemia levels of over 180 mg/dl should be avoided	Strong +	Moderate
89	After surgery, patients should undergo strict glycaemic control of under 110 mg/dl	Strong +	High
90	The objective of post-surgical hyperglycaemia treatment in diabetic patients is not formally defined. However, values of under 110 mg/dl or over 150 mg/dl seem to be harmful and should be avoided.	Strong +	Moderate
	<b>DRAINAGES</b>		
91	The use of drainage is not recommended, with the exception of pelvic surgery.	Strong -	High
	<b>POSTOPERATIVE PROCEDURE</b>		
	<b>Early feeding</b>		
92	Early feeding within the first 24 postoperative hours is recommended.	Strong +	High
	<b>Early mobilisation</b>		
93	Mobilisation during the first 24 post-surgery hours is recommended.	Strong +	High
	<b>Respiratory physiotherapy</b>		
94	The execution of preoperative and postoperative respiratory physiotherapy is recommended.	Strong +	High
	<b>RECOMMENDATIONS ON DISCHARGE</b>		
95	Patients and their caregivers must receive personalised, understandable and complete information when discharged. Planning the discharge and adequately informing about care after discharge influences the average stay and re-admissions.	Strong +	High



# Assessment

## ASSESSMENT INDICATORS

General indicators to analyse the quality of the care process are presented in this section. Standards are not included as, in abdominal surgery, there are different surgical procedures with differing results. Furthermore, it is not possible to find references in many of the process indicators.

### PROCESS INDICATORS

#### Coverage adaptation.

- Patients who satisfy the Enhanced Recovery for Abdominal Surgery inclusion criteria and have been entered into the programme x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery

#### Procedure adaptation

- Patients operated on who satisfy the Enhanced Recovery for Abdominal Surgery inclusion criteria x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery

#### Preoperative information

- Patients operated on Enhanced Recovery for Abdominal Surgery who have been provided with oral and written information\* x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery

#### Preoperative evaluation

- Patients operated on in Enhanced Recovery for Abdominal Surgery on whom an appropriate preoperative evaluation has been carried out\* x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery

#### Mechanical preparation (coloproctological surgery).

- Patients operated on in Enhanced Recovery for Abdominal Surgery with colon resection on whom intestinal cleansing has been carried out x 100

Patients in Enhanced Recovery for Abdominal Surgery with colon resection

### Preoperative medication

- Patients operated on in Enhanced Recovery for Abdominal Surgery who have been prescribed adequate preoperative medication\* x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery (\*)

### Fasting and preoperative hydrocarbonate diet

- Patients operated on in Enhanced Recovery for Abdominal Surgery with adequate pre-operative diet and fasting time\* x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery

### Thromboembolism prophylaxis

- Patients operated on in Enhanced Recovery for Abdominal Surgery with adequate thromboembolism prophylaxis\* x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery

### Antibiotic prophylaxis

- Patients operated on in Enhanced Recovery for Abdominal Surgery who have been prescribed adequate antibiotic prophylaxis\* x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery

### Surgical approach (critical point)

- Patients operated on in Enhanced Recovery for Abdominal Surgery on whom a laparoscopic approach has been carried out\* x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery

### Management of fluids (critical point)

- Patients operated on in Enhanced Recovery for Abdominal Surgery with correct administration of fluids in peroperative\* x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery

### Prevention of hypothermia

- Patients operated on in Enhanced Recovery for Abdominal Surgery with correct prevention of intraoperative hypothermia\* x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery

### Drainage of abdominal cavity after anastomosis

- Patients operated on in Enhanced Recovery for Abdominal Surgery who have been fitted with intra-abdominal drainage x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery

### Nasogastric tube

- Patients operated on in Enhanced Recovery for Abdominal Surgery who have been fitted with nasogastric tube x 100

Patients operated on in Enhanced Recovery for Abdominal Surgery



### Analgesia (critical point)

- Patients operated on in Enhanced Recovery for Abdominal Surgery on whom correct analgesia has been carried out x 100  
Patients operated on in Enhanced Recovery for Abdominal Surgery

### Nutritional intake

- Patients operated on in Enhanced Recovery for Abdominal Surgery on whom correct nutritional support has been carried out\* x 100  
Patients operated on in Enhanced Recovery for Abdominal Surgery

### Early mobilisation

- Patients operated on in Enhanced Recovery for Abdominal Surgery on whom correct post-operative mobilisation has been carried out\* x 100  
Patients operated on in Enhanced Recovery for Abdominal Surgery

## RESULT INDICATORS

### Clinical effectiveness

- Patients operated on in Enhanced Recovery for Abdominal Surgery who require second operation due to bleeding x 100  
Patients operated on in Enhanced Recovery for Abdominal Surgery
- Patients operated on in Enhanced Recovery for Abdominal Surgery who require admission into critical units x 100  
Patients operated on in Enhanced Recovery for Abdominal Surgery
- Patients operated on in Enhanced Recovery for Abdominal Surgery with non-scheduled re-admission within 30 days after the operation due to reasons related to surgery x 100  
Patients operated on in Enhanced Recovery for Abdominal Surgery
- Patients operated on in Enhanced Recovery for Abdominal Surgery who die within 30 days after the operation x 100  
Patients operated on in Enhanced Recovery for Abdominal Surgery
- Patients operated on in Enhanced Recovery for Abdominal Surgery who present SSI within 30 days after the operation x 100  
Patients operated on in Enhanced Recovery for Abdominal Surgery  
SSI Surgical Site Infection

### Effectiveness

- Patients operated on in Enhanced Recovery for Abdominal Surgery who have fulfilled the scheduled stay\* x 100  
Patients operated on in Enhanced Recovery for Abdominal Surgery

### Patient satisfaction

- Patients operated on in Enhanced Recovery for Abdominal Surgery who say they are very satisfied\* x 100  
Patients operated on in Enhanced Recovery for Abdominal Surgery

(\*) These indicators require defining explicit criteria.



# Clinical Pathway Implementation Process

In the future implementation process of the Clinical Pathway, at a local level it is important to identify and count on a person responsible for the implementation of the Enhanced Recovery Abdominal Surgery Clinical Pathway.

This person responsible will be in charge of:

- Verifying that the needs of the pathway are covered, ensuring dissemination of the Clinical Pathway to all professionals involved.
- Organising the training of all professionals involved, for them to be familiar with and adequately use all the documents included in the Clinical Pathway.
- Monitoring, assessing and periodically informing all personnel of the advances and adopt the necessary measures to achieve improvements.
- Coordinating the review and updating the Clinical Pathway content.

## IMPLEMENTATION PROCESS

The implementation process of the Clinical Pathway is gradual, and this process will help define the specific objectives that purport to reach compliance with each activity or recommendation included in the Clinical Pathway, in a feasible manner.

The objectives must include aspects of the care process (such as the degree of compliance with recommendations) and of the results that must be obtained, bearing in mind that normally the tendency is to initially comply with the process assessment indicators and the last ones to be reached are usually the result indicators.

Objectives established will be based on the current situation of the specific activity (starting situation), if this information is available.

The scope of the implementation will take place, bearing in mind the assessment indicators included in the Clinical Pathway.

The following implementation strategy is specified and proposed, although the most favourable strategy –the one with less barriers– must be adopted.

## Implementation Strategies

Ideally, the adoption of the Clinical Pathway should be agreed by consensus with anaesthesiologists and surgeons who are familiar with the scientific evidence and with capacity to form a multi-disciplinary work group.

The work group should be comprised of:

- Project leader (surgeon or anaesthesiologist)
- Hospital management representative (for example: Quality Unit Coordinators)
- Anaesthesiologist
- Surgeon
- Nurse
- Nutritionist
- Representative from pain unit
- Primary care representative
- Occupational therapist/social worker
- Physiotherapist
- Patient association representative

## TEAM

It is very important for the people involved and who make up the group to cooperate closely in order to develop the project, and for the leader to have the capacity to promote the necessary changes to carry it out.

The work group has been following main functions:

1. Assess the normal clinical practice before implementing the new protocol.
2. Reach an agreement about the changes that must be made.
3. Identify possible barriers to the change.
4. Study the economic impact to carry out the project.
5. Create an action plan to transform the normal clinical practice.
6. Agree to objectives and how to assess them.
7. Create an evidence-based protocol adapted to the needs and peculiarities of the population.
8. Act as a model and solve doubts for the rest of the team.

## ANNEX 1

### GRADE METHODOLOGY ASSESSMENT SYSTEM<sup>b</sup>

MEANING OF EVIDENCE QUALITY LEVELS	
Quality of evidence	Definition
High	There is high confidence in the effect estimator being very close to the real effect.
Moderate	There is moderate confidence in the effect estimator: The effect estimator is likely to be close to the real effect but there is a possibility of there being substantial differences.
Low	The confidence in the effect estimator is low: The effect estimator can be substantially different to the real effect.
Very low	There is very low confidence in the effect estimator: The effect estimator is very likely to be substantially different to the real effect.

b. Alonso-Coello P, Rigau D, Sanabria AJ, Plaza V, Miravittles M, Martínez L. Quality and strength, the GRADE system to formulate recommendations in clinical practice guidelines. Arch Bronconeumol 2013;49(6):261-7

ASSESSMENT OF THE QUALITY OF EVIDENCE ACCORDING TO THE TYPE OF STUDY DESIGN				
Study design	Initial Quality of evidence	Reduce if	Increase if	Quality of the evidence as a whole
Randomised clinical trials Quasi-experimental studies	High	Limitations in the design or execution (Methodological) Important (-1) Very important (-2)	Association strength (Operation VS variable) Strong (+1) [RR>2 & CI<0.5 in 2 or more observational studies] Very strong (+2) [RR>5 & CI<0.2]	High ⊕⊕⊕⊕
		Inconsistency Important (-1) Very important (-2)	Dose-response gradient Present (+1)	Moderate ⊕⊕⊕⊕
Observational Studies Other Studies	Low	Uncertainty in that the evidence is direct Important (-1) Very important (-2)	Consideration of possible confusion factors that would have reduced the effect (+1) They would suggest a spurious effect if there is not effect (+1)	Low ⊕⊕⊕⊕
		Imprecision Important (-1) Very important (-2)	All or nothing	Very low ⊕⊕⊕⊕
		Publication bias Important (-1) Very important (-2)		

IMPLICATIONS OF THE RECOMMENDATIONS			
Degree	PRE-REQUISITES	Implications of a strong recommendation	
Strong (level 1)		For patients	The majority of people would agree to the recommended operation and only a small proportion would not.
		For clinicians	The majority of patients should receive the recommended operation
		For managers	The recommendation may be adopted as health policy in the majority of the situations
Weak (level 2)	Moderate or high quality of evidence  The benefit/harm balance or others advise a weak recommendation   (If it is based on the Consensus) Evidence quality low, very low or non-existent but with firm criteria that benefit>> harm.	Implications of a weak recommendation	
		For patients	The majority of people would agree to the recommended action but a considerable number of them would not.
		For clinicians	It is acknowledged that different options will be appropriate for different patients and that the physician has to help each patient reach the decision that is most consistent with his or her values and preferences
		For managers	An important discussion is required with the participation of the stakeholders.

## ANNEX 2

### APFEL SCALE

#### POSTOPERATIVE NAUSEA AND VOMITING PROPHYLAXIS

##### Apfel Model for risk stratification

RISK FACTORS	SCORE	RISK
Woman	1	Basal: 10%
Non-smoker	1	1 point: 20%
Prior history of PONV and/or kinetosis	1	2 points 40%
Use of postoperative opioids	1	3 points 60%
		4 points 80%
Low risk (0-1 point, 10-20%), moderate (2 points, 40%); high (3-4 points, 60.80%)		



## ANNEX 3

### TIME MATRIX

#### ENHANCED RECOVER ABDOMINAL SURGERY CLINICAL PATHWAY

TIME	PROTOCOL	RESPONSIBILITY
Prior to admission	Preoperative evaluation. Nutritional, cardiological, anaemia optimisation and comorbidity, if relevant.	Surgeon + Anaesthesiologist
Immediate preoperative (preferably without admission)	Diet adaptation Start thromboembolic prophylaxis* 6 hours without solid food and 2 hours without clear liquid Mechanical preparation is not necessary for colon surgery, and its use is selective in rectum surgery. <i>* If the patient is admitted the previous afternoon, this will be carried out when admitted.</i>	Anaesthesiologist + Nursing + Surgeon
Peroperative	<b>Immediate preoperative</b> Cleansing enema 7 am (in rectum-sigma resection in those cases where indicated) Placement of compression socks or intermittent pneumatic compression, depending on thromboembolic risk Carbohydrate drink supplement: 12.5% maltodextrins 250 cc 2 hours prior to operation Prophylactic administration of antibiotic 1 hour prior to surgical incision when this is indicated (or in operating theatre)	Nursing
Peroperative	<b>Intraoperative</b> Insertion of epidural catheter in open surgery Anaesthetic induction FiO2 0.6-0.8 oxygenisation Haemodynamic optimisation via goal-directed fluid therapy (GDFT) Fluid therapy in continuous balanced solution perfusion (3.5 ml/kg/h for laparoscope; 7 ml/kg/h for laparotomy) Bladder catheterisation if required Minimally invasive surgery (whenever possible) No nasogastric tube Active warming with thermal blanket and fluid heater Postoperative nausea and vomitong prophylaxis according to Apfel scale No drainage Infiltration of laparoscope ports or train-of-four (TAP) according to operation	Nursing + Anaesthesiologist + Surgeon

TIME	PROTOCOL	RESPONSIBILITY
Peroperative	<b>Immediate postoperative</b> Active maintenance of temperature Maintenance of FiO <sub>2</sub> 0.5 2 hours after operation ends. Prescribed analgesics according to operation. Minimal administration of morphics Restrictive fluid therapy Start of oral tolerance 6 hours after surgery Start of mobilisation 8 hours after surgery Prophylaxis of thromboembolism with enoxaparin 40mg 10 pm.	Nursing + Anaesthesiologist
1 <sup>st</sup> postoperative day	Nutritional supplement in selected cases Normal diet according to tolerance Consider removing drainage, if any Active mobilisation (bed/chair/start to walk) Intravenous analgesia. No morphics If oral tolerance is correct, remove intravenous liquids Consider removing bladder catheterisation, if any	Nursing + Surgeon
2 <sup>nd</sup> postoperative day	Consider removing bladder catheterisation (if it exists) Normal diet Active mobilisation (walking) Removal of intravenous liquids Prophylaxis of thromboembolism Consider discharge to home.	Nursing + Surgeon
During remaining hospitalisation	Normal diet Oral analgesia Active mobilisation (walking) Thromboembolism prophylaxis Consider discharge to home	Nursing + Surgeon
On discharge	Maintenance of thromboprophylaxis 28 days after surgery Telephone control after discharge General discharge criteria: No surgical complications, no fever, pain controlled with oral analgesia, complete walking, acceptance by patient Monitoring after discharge/care continuity Home support-Coordination with Primary Healthcare	Nursing + Surgeon - PCP

ALGORITHMS

ENHANCED RECOVERY ABDOMINAL SURGERY CLINICAL PATHWAY

Figure 1

Nutritional assessment algorithm

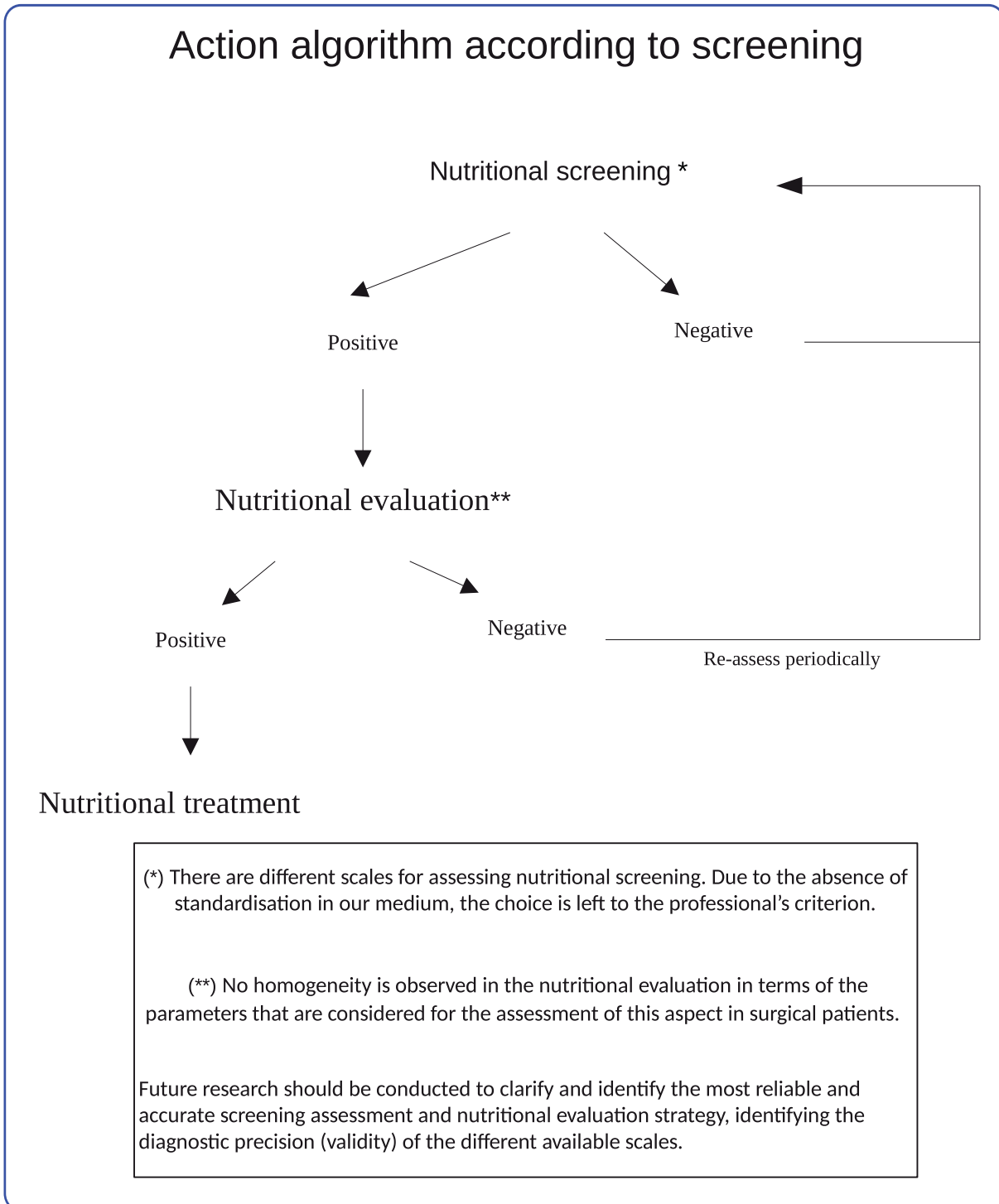
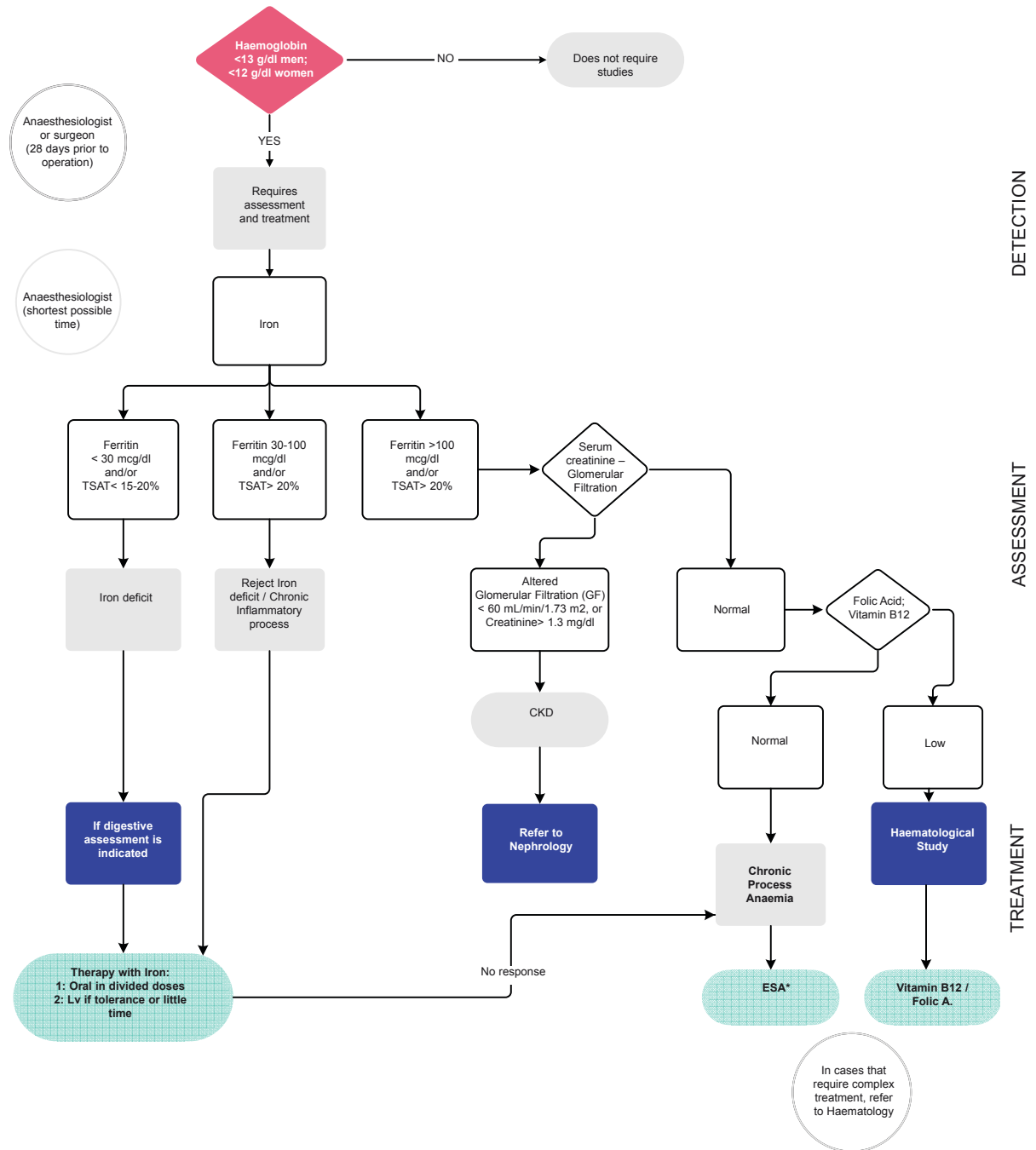


Figure 2.

## Algorithm for preoperative management of anaemic patients



Assessment and treatment: responsibility of anaesthesiologist in shortest time possible, unless referred to haematologist.

CKD = Chronic Kidney Deficiency

Altered Glomerular Filtration – Serum Creatinine: (GF) < 60 mL/min/1.73 m<sup>2</sup> or Creatinine > 1.3 mg/dL.

TSAT = Transferrin Saturation.

ESA = erythropoiesis-stimulating-agents

Figure 3

# Preoperative management algorithm

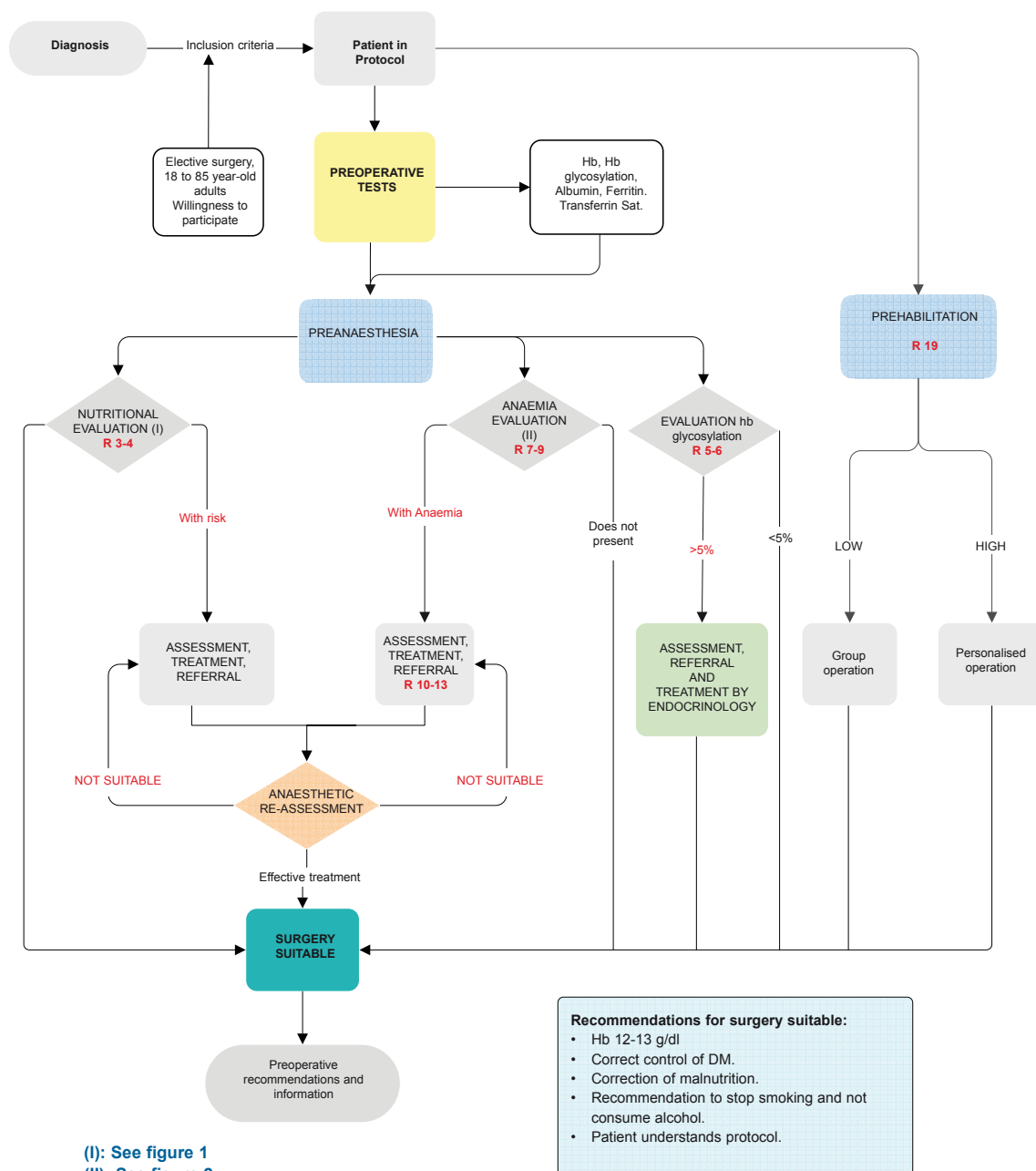
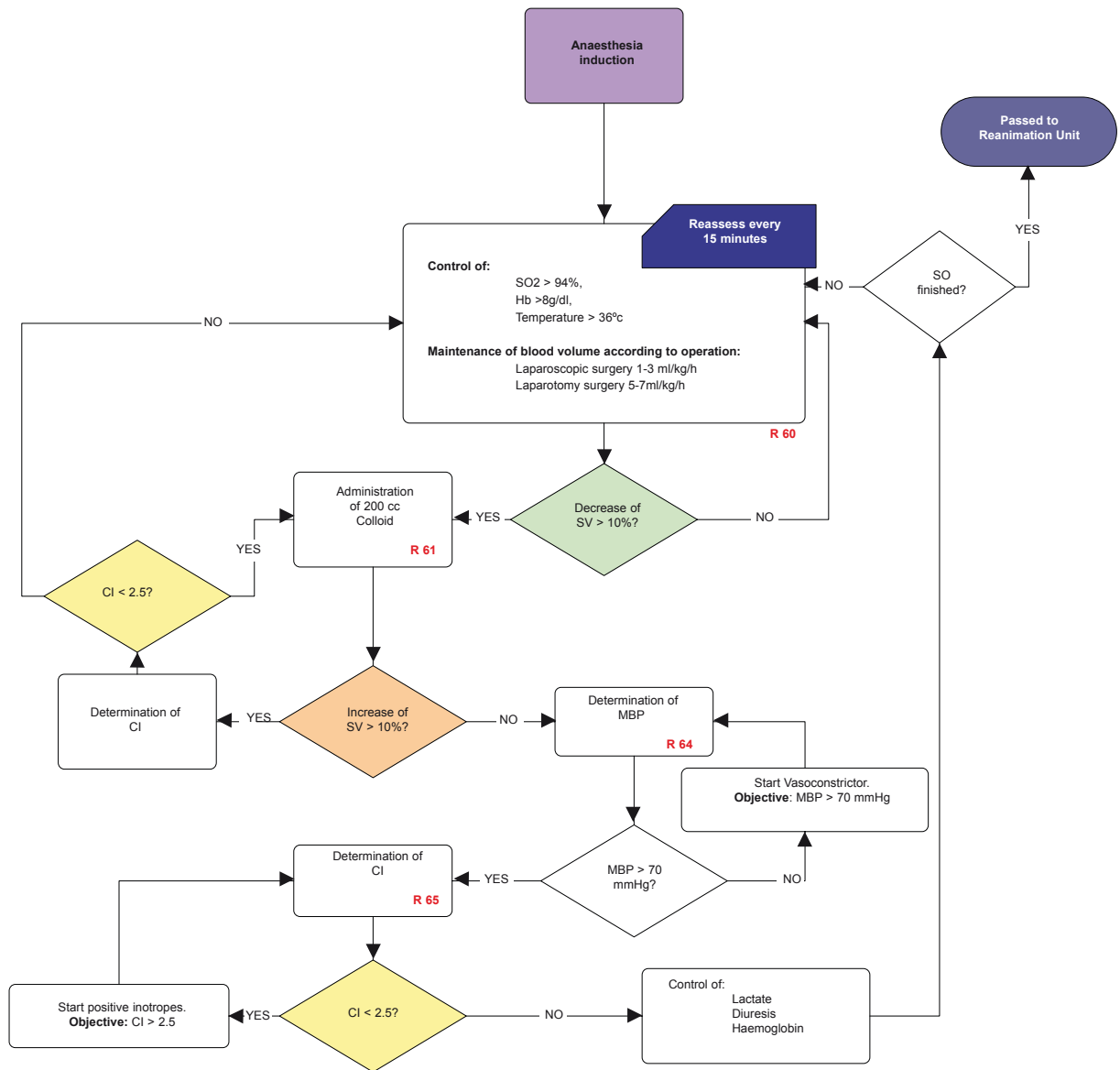


Figure 4

## Algorithm of goal-guided fluid therapy (GDFT)

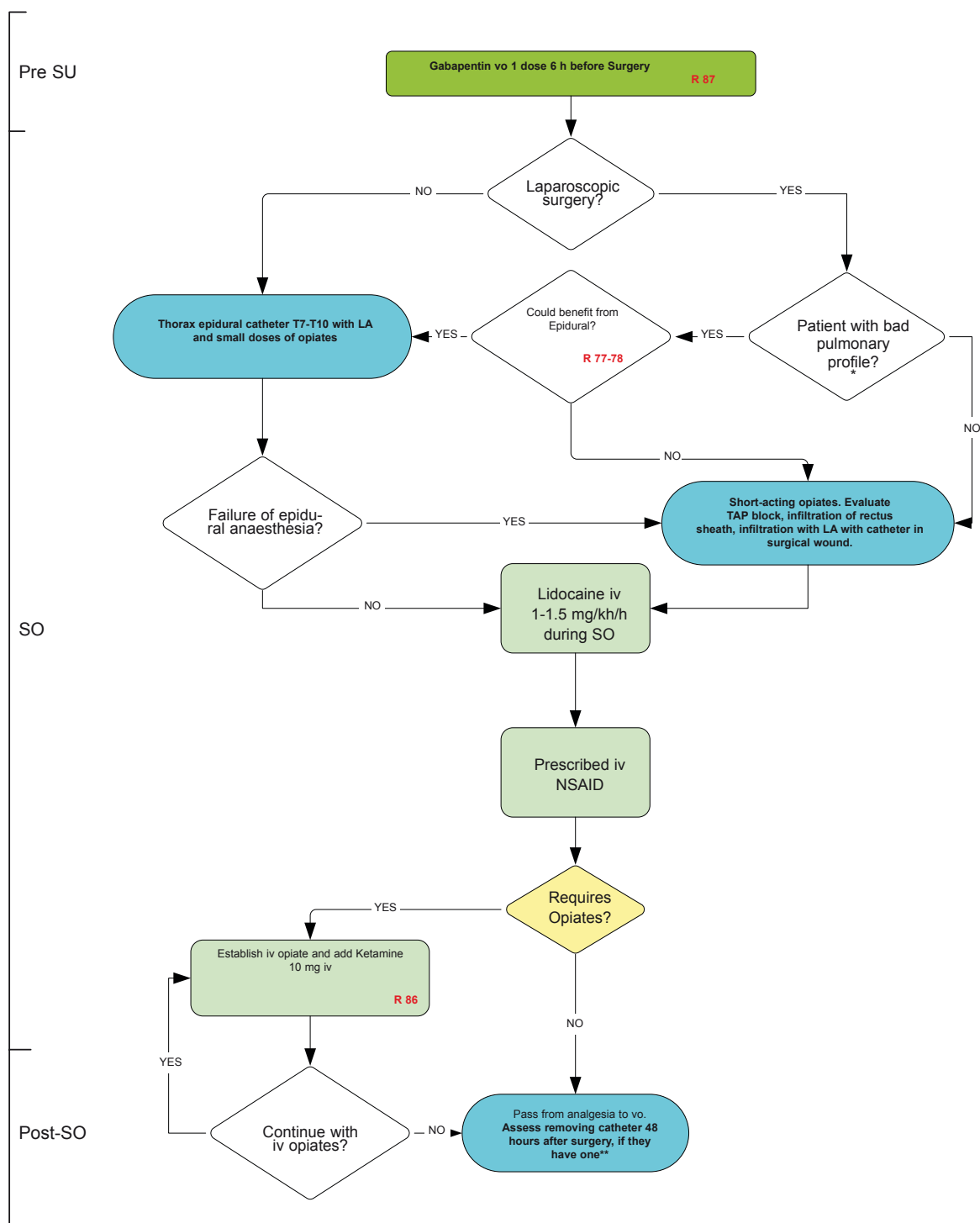


Recommendations for goal-directed fluid therapy:  
From R 60 to R 66

CI: Cardiac Index  
SO: Surgical Operation  
MBP: Mean blood pressure  
SV: Stroke volume

Figure 5

# Analgesia management algorithm



Recommendations on management of Analgesia:  
From R 67 to R 87

\*: Criteria of bad pulmonary f(x)  
\*\*: Criteria of catheter maintenance  
LA: Local anaesthetics

## ANNEX 5

### SATISFACTION SURVEY

#### ENHANCED RECOVERY ABDOMINAL SURGERY CLINICAL PATHWAY

Dear patient,

We would like to know your opinion about the health care provided through the Enhanced Recovery Abdominal Surgery Clinical Pathway to be able to improve the quality that we provide our patients, so we would be grateful if you could answer this anonymous questionnaire.

Thank you for the interest and attention you have shown. This will help us improve our work.

Enhanced Recovery for Abdominal Surgery Team

#### General data

Age:            Gender: Male ☐ Female ☐ Nationality: Spanish ☐ Other ☐  
Study level: No studies ☐ Primary ☐ Intermediate ☐ Higher ☐

#### Medical details

The surgery performed was:  
General surgeon ☐ Urologist ☐ Gynaecologist ☐ Several ☐ Others ☐

#### Preoperative Information

You would describe the information you received from the surgeon prior to the operation, as:  
Very good ☐ Good ☐ Regular ☐ Bad ☐ Very bad ☐  
You would describe the information you received from the anaesthetist prior to the operation, as:  
Very good ☐ Good ☐ Regular ☐ Bad ☐ Very bad ☐  
You would describe the information you received from the nurse prior to the operation, as:  
Very good ☐ Good ☐ Regular ☐ Bad ☐ Very bad ☐ Did not inform me ☐

#### Treatment received

You would describe the treatment received by the surgeon who attended to you as:  
Very good ☐ Good ☐ Regular ☐ Bad ☐ Very bad ☐  
You would describe the treatment received by the anaesthetist who attended to you as:  
Very good ☐ Good ☐ Regular ☐ Bad ☐ Very bad ☐  
You would describe the treatment received by the nurses who attended to you as:  
Very good ☐ Good ☐ Regular ☐ Bad ☐ Very bad ☐  
You would describe the treatment received by the health personnel who attended to you as:  
Very good ☐ Good ☐ Regular ☐ Bad ☐ Very bad ☐



### Facilities and equipment

You would describe the theatre where you were operated and its equipment as:

Very adequate ☐ Quite adequate ☐ Adequate ☐ Not very adequate ☐ Not at all adequate ☐

The room where you remained after your passage through the ICU – PARU was:

Single ☐ Double ☐ Other ☐

In your opinion, the room where you remained after your passage through the PARU was:

Very adequate ☐ Quite adequate ☐ Adequate ☐ Not very adequate ☐ Not at all adequate ☐

### Pain

How would you describe your pain level after surgery?

(0 = no pain => 10 = unbearable pain)

0      1      2      3      4      5      6      7      8      9      10

### Postoperative Diet

Did you have nausea or vomiting after being operated: YES ☐ NO ☐

When they told you that you had to drink or eat, did you think it was:

Too soon ☐ A bit soon ☐ Timely ☐ Late ☐ Very late ☐

### Postoperative mobilisation

When they told you that you had to get out of bed and sit on the chair, did you think it was:

Too soon ☐ A bit soon ☐ Timely ☐ Late ☐ Very late ☐

When they told you to walk, did you think it was:

Too soon ☐ A bit soon ☐ Normal ☐ Late ☐ Very late ☐

### Hospital discharge

Would you describe the information and recommendations you received from the surgeon when you were discharged as:

Very good ☐ Good ☐ Average ☐ Bad ☐ Very bad ☐ They did not inform me ☐

Would you describe the information and recommendations you received from the nurses when you were discharge as:

Very good ☐ Good ☐ Average ☐ Bad ☐ Very bad ☐ They did not inform me ☐

You had to call the contact telephone that they gave you: YES ☐ NO ☐ They did not give me one ☐

### Professional competence and coordination

In your opinion, did you consider the professional competence level of the surgeon as:

Very high ☐ High ☐ Normal ☐ Low ☐ Very low ☐

In your opinion, did you consider the professional competence level of the anaesthetist as:

Very high ☐ High ☐ Normal ☐ Low ☐ Very low ☐

In your opinion, did you consider the professional competence level of the nurses as:

Very high ☐ High ☐ Normal ☐ Low ☐ Very low ☐

In your opinion, did you consider the professional competence level of other health professionals as:

Very high ☐ High ☐ Normal ☐ Low ☐ Very low ☐

In terms of the coordination of the members, they were:

Very coordinated ☐ Quite coordinated ☐ Coordinated ☐

Not very coordinated ☐ Not at all coordinated ☐

If you had to be operated on again, would you choose an operation following the Enhanced Recovery for Abdominal Surgery model?: YES ☐ NO ☐

If a relative of yours had to be operated, would you recommend the Enhanced Recovery for Abdominal Surgery model?: YES ☐ NO ☐

### General satisfaction

What is your global satisfaction with the health care provided

Very satisfied ☐ Quite satisfied ☐ Satisfied ☐ Not very satisfied ☐ Dissatisfied ☐

Remarks:

The most negative part for you was:

The most positive part for you was:

Indicate what improvements could be included in your opinion:

Thank you very much for your collaboration

## ANNEX 6

### INFORMATION FOR THE PATIENT

#### ENHANCED RECOVERY ABDOMINAL SURGERY CLINICAL PATHWAY

1. Introduction
2. Preparation at home / Pre-admission
3. During your stay at hospital
4. Discharge home

#### INTRODUCTION

This **Enhanced Recovery Abdominal Surgery Clinical Pathway** that you are participating in on the occasion of your operation, is different to traditional treatment. It consists in applying a series of measures to minimise the impact and organic repercussion entailed in any surgical operation, reducing possible complications, speeding up recovery and even possibly reducing the hospital stay.

Your active collaboration as a patient and that of your relatives or caregivers, as well as the fulfilment of all its phases, are essential for the good functioning and success of this programme.

There are three main phases:

1. Preparation prior to admission
2. During your stay in hospital
3. Recommendations on discharge

The multidisciplinary team that will care for you throughout this Clinical Pathway has been trained to solve all your doubts and guide you through the development of each phase of the Programme.

#### PREPARATION PRIOR TO ADMISSION

The prior preparation of the patient is essential, ensuring that the patient is in the best possible conditions, identifying the personal risks during the preoperative procedure.

You will visit the surgery, anaesthesia and nursing consultations to receive all the necessary information about the details of your operation and the tasks that require your prior collaboration in this programme.

We set out your more immediate objectives, prior to the day you are admitted, below:

**If you smoke, stop smoking.** It is important to understand that if you make an effort to reduce your consumption of tobacco, this will have a direct effect on reducing possible respiratory complications that you might suffer during the surgical process. If you want, at your health centre they will inform you about the programmes to help you stop smoking.

**Respiratory physiotherapy exercises:** with surgery, the risk of presenting respiratory complications may increase. To prevent them your nurse will teach you to work on your respiratory muscles, using the incentive spirometer, as well as exercises that you must carry out with this tool on the days prior to the surgery.

**Preoperative nutrition:** high energy expenditure is going to be required during surgery, and the previous nutritional state of the patient will be very important to favour healing and defence of the organism against infection.

To achieve a better preoperative nutritional status, we suggest following a *hypercaloric and higher-protein rich diet*, as well as correct hydration.

At least ten days prior to surgery, the patient must follow a protein-rich diet, avoiding the use of fat for cooking.

The two days prior to surgery, the patient will follow a *low residue diet* to have less faeces in his/her bowels.

The night before the operation, he/she will eat food until six hours prior to surgery. Patients who are going to undergo surgery, will be given some specific carbohydrate-rich drinks in the consultation in order to reinforce their nutritional status. The pattern they must follow for these drinks is given below:

- **The day prior to surgery** they will take four cartons.
- **On the morning of surgery**, they will take two cartons which they must have finished two hours before the operation.
- **They cannot have anything during the two hours prior to surgery.**

**They must not have any alcoholic drinks** as alcohol is related to postoperative complications.

**Exercise prior to surgery** and moderate physical exercise prior to admission will favourably contribute to their subsequent recovery. Your nurse will advise you what type of activity you can engage in, depending on your physical status.

## DURING YOUR STAY IN HOSPITAL

After surgery, the team of professionals attending to you will tell you what steps you must take for your day-to-day recovery. Remember that your collaboration and involvement is essential for the adequate progress of your evolution.

To help prevent possible complications that are typical of any surgery, we will work on three fundamental fields:

1. Early mobilisation
2. Early nutrition
3. Respiratory physiotherapy exercises

## EARLY MOBILISATION

This is an important point that differs from the management of postoperative procedures in traditional surgery. In this programme you can get up after the operation and walk earlier than normal. Your ideal progression would be:

**Day of the operation**, the nursing personnel will help you get out of bed to sit in your chair. You should try to stay out of bed and seated for up to two hours.

**On the day after the operation**, you may remain seated at intervals in the chair for up to six hours, apart from walking short distances, around four series of 60 metres.

**On successive days** you will continue to walk, attempting constant progression.

Surgery brings bowels to a stand-still for a variable time that can be shortened if you get up and walk after the operation and is prolonged if you remain in bed.

## EARLY NUTRITION

One of the basic principles of this programme is the start of early tolerance, but as a general rule, the patient must establish the rhythm providing he/she tolerates it adequately.

**The same day of the operation,** when you leave the operating theatre, it is important for you to drink, unless you feel poorly. Try to drink around five glasses of liquid. They will give you energy drinks once you have got out of bed and into the chair.

**On the day after the operation,** your liquid intake will increase to 1 and a half litres. You must avoid carbonated drinks. The hyperprotein drinks that you are given will help you recover from the surgical stress represented by surgery, and will also help the wounds heal better. Try to have at least 3 hyperprotein drinks every day.

**On successive days** if you are tolerating liquids well, you will go on to a more solid diet. It is more advisable for you to eat small amounts of food several times during the day than large amounts; you will feel better. If you feel unwell or have nausea, rest for a couple of hours and try again.

Carry on drinking a lot of liquid

## RESPIRATORY PHYSIOTHERAPY EXERCISES

In any surgery, the risk of respiratory complications increases due to resting in bed, discomfort in the incision site and other factors. The risk can be prevented by means of thorax mobilisation, which will be carried out with the incentive spirometer.



With the constant use of the incentivator, you will be able to:

- Increase alveolar ventilation, preventing pneumonia.
- Increase the strength of the respiratory muscles
- Increase pulmonary volume
- Mobilise secretions

Approximately 4 to 6 hours after the operation, you can start to use the incentivator. The frequency of use will be every 2 hours for 10 minutes on each occasion. Gradually increase the volume of the inspiriometer progressively by way of training.

If you have any doubts on how to use it, consult the health personnel.

## RECOMMENDATIONS ON DISCHARGE

The high planning level that exists behind any Enhanced Recovery for Abdominal Surgery means that all the practical support you are going to need at home must be prepared.

The planning foreseen for you will be reviewed and validated by the doctors and nurses responsible for your hospital discharge.

You may have been informed in advance of your probable discharge date by your physician. This will make it easier for you to prepare everything you need to go home, or to the care centre if you require this, sufficiently in advance.

The Enhanced Recovery for Abdominal Surgery Clinical Pathway control team will provide you with a contact telephone so that you can consult any doubts you may have during the first 24 hours after discharge.

The control team will inform your health centre (by e-mail or telephone) of your discharge home for them to control you during the next 48 hours.

Your hospital discharge is based on specific criteria and objectives. When you achieve them you will be able to be discharged.

These criteria are:

- Effective control of pain with oral analgesics.
- Good oral tolerance of liquids, and diet, without nausea or vomiting.
- Autonomy in mobility.
- Completed teaching programme on management of ostomy.

If you require further information, do not hesitate to consult your doctor or the Unit Nurse.

## ANNEX 7

### DECLARATION OF INTERESTS

#### ENHANCED RECOVERY ABDOMINAL SURGERY CLINICAL PATHWAY

##### Declaration of interests.

The following members of the **development** team have declared there is no conflict of interests.

José María Calvo Vecino, Emilio Del Valle Hernández, Juan José Hernández Aguado, Carmelo Loínaz Seguro, Carlos Martín Traperó, Carmen G. Nogueiras Quintas, José Manuel Ramírez Rodríguez, Alfredo Rodríguez Antolín, Elías Rodríguez Cuellar, Pedro Ruiz López.





# Abbreviations

ABT	Allogenic Blood Transfusion
BSI	Bispectral index
CI	Cardiac Index
CVC	Central Venous Catheter
DXA	Dual X-ray Absorptiometry. Densitometry.
ECG	Electrocardiogram
ER	Enhanced Recovery
ERAS	Enhanced Recovery After Surgery
ERP	Enhanced Recovery Programme
ETCO <sub>2</sub>	Capnography (Fraction End Tidal de CO <sub>2</sub> )
FiO <sub>2</sub>	Fraction of inspired oxygen
GDFT	Goal-directed Fluid therapy
LMWH	Low Molecular Weight Heparin
MAS	Major Abdominal Surgery
MAS	Major Abdominal Surgery
MRP	Multimodal Rehabilitation Programme
NFH	Non-fractioned heparin
NIBP	Non-Invasive blood Pressure
NMB	Neuromuscular block
NGT	Nasogastric tube
NSAID	Non-Steroid Anti-inflammatory Drugs
OSAS	Obstructive Sleep Apnoea Syndrome
PARU	Post-Anaesthetic Recovery Unit
PCP	Primary care physician
PONV	Postoperative procedure Nausea and Vomiting
RCT	Randomised clinical trial
SV	Stroke volume
SVV	Stroke Volume Variation
TOF	Train of Four
VAS	Visual Analogue Scale



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\* Article of special importance

\*\* Article of extraordinary importance or with very significant contributions.

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## NEUROMUSCULAR BLOCK AND OPIATE REVERSAL

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