

## The Obstetrician & Gynaecologist

# [Title] Life in the laparoscopic fast lane: evidence-based perioperative management and enhanced recovery in benign gynaecological laparoscopy

[Running title] Life in the laparoscopic fast lane

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### Contribution to authorship

ABS initiated the idea, performed the literature search, and co-wrote the article. SAS, JL, and MW co-wrote the article. All authors approved the final version.

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Article type : Reviews

**Key content**

- Enhanced recovery after surgery (ERAS) protocols aim to shorten the length of hospital stay and expedite recovery, without increasing complications or readmission rates.
- Implementation of ERAS protocols should be evidence-based, including when applied to pre-admission clinic (including preoperative investigations), fasting, antibiotic prophylaxis, thromboprophylaxis, analgesia, expeditious removal of urinary catheters and early mobilisation.

**Learning objectives**

- To understand evidence-based perioperative management of patients undergoing laparoscopic procedures for benign gynaecological indications.
- To appraise critically the judicious ordering of preoperative investigations.
- To understand the importance of preoperatively assessing and managing each patient's risk of venous thromboembolism..
- To understand the key components of perioperative management that decrease surgical site infection(s).

**Ethical issues**

- Preoperative patient education is a vital component of perioperative management; written materials should be prepared in languages other than English to enable all patients to benefit from the ERAS approach.

- 29 • A balance must be found between applying ERAS protocols as a checklist to ensure all aspects  
30 of patient care have been considered and tailoring those protocols to each patient's individual  
31 needs.

32

33 **Keywords**

34 benign laparoscopy, enhanced recovery, evidence-based medicine, perioperative management,  
35 same-day surgery

36

37 **[Heading 1] Introduction**

38 Perioperative medicine encompasses the period between the moment surgery is contemplated  
39 and the patient's complete recovery. Enhanced recovery after surgery (ERAS) pathways  
40 standardise a variety of evidence-based perioperative interventions, ensuring patients are in  
41 prime condition for surgery (thereby minimising postponements and cancellations), receive  
42 optimal individualised and evidence-based care intraoperatively, and return to their normal lives  
43 as rapidly as possible. ERAS pathways focus on elements that may delay postoperative recovery,  
44 such as gut function, pain and immobility.

45 While initially developed for patients undergoing open colorectal surgery, there is mounting  
46 evidence that the ERAS approach is applicable to benign gynaecological laparoscopy.<sup>1</sup> The  
47 numerous, well-documented benefits of laparoscopy can be thwarted by nausea and vomiting,  
48 fluid overload, restricted ambulation, deconditioning and poorly controlled pain.<sup>2</sup> Applying  
49 evidence-based ERAS protocols to benign gynaecological laparoscopy reduces the incidence of  
50 such complications, thereby minimising the physiological effects of surgery.<sup>3</sup> Moreover, ERAS  
51 pathways increase patient satisfaction, decrease intravenous fluid administration, cost and  
52 morphine equivalents consumed, and expedite recovery, all without increasing complication or  
53 readmission rates.<sup>4</sup> Most patients undergoing gynaecological laparoscopy have short hospital  
54 stays (e.g. same-day discharge or overnight admission only). Implementing evidence-based ERAS  
55 pathways enables patients' length of stay to be measured in hours, rather than days.<sup>5</sup> One study  
56 found that implementation of an ERAS pathway following laparoscopic hysterectomy decreased  
57 the average length of stay from 34 to 20 hours.<sup>6</sup>

58 This article provides a chronological outline of evidence-based perioperative management for  
59 benign gynaecological laparoscopy, from a patient's preoperative outpatient clinic appointment,  
60 to their postoperative recuperation.

61

62 **[Heading 1] Outpatient preoperative management**

63 *[Heading 2] Gynaecology clinic*

64 When an operation is booked, surgeons should specify the operation needed and which surgeon is  
65 best placed to perform that operation, and obtain patient consent. ERAS information should be  
66 conveyed in both verbal and written forms, encompassing perioperative expectations about  
67 patients' active involvement in their care.

68 When pertinent, clinicians should foreshadow how patients can improve their preoperative  
69 condition by ceasing smoking, optimising weight and managing their comorbidities (e.g.  
70 hypertension and diabetes).

71 Mounting evidence supports screening for and treating bacterial vaginosis (BV) prior to  
72 hysterectomy. These recommendations are based on the prevalence of BV, the efficacy and low  
73 cost of treatment and the link between BV and surgical site infections.<sup>7</sup> While such practice is not  
74 routine in the UK, the adoption of BV screening prior to hysterectomy is evidence-based and  
75 recommended.

76 The authors' international experience (in the USA and Australia) confirms the importance of a  
77 weekly multidisciplinary team (MDT) meeting, during which patients who have surgery booked in  
78 the coming month (and who have not yet been discussed in a previous MDT meeting) are  
79 reviewed. Discussion of patients at this MDT meeting should be on an 'opt out' basis; that is, all  
80 patients are reviewed, except well patients having minor surgery. Ideally, nonmedical personnel  
81 (e.g. pharmacy and nursing staff) should be involved because MDT discussions often pre-empt  
82 several perioperative challenges.

83

84 *[Heading 2] Pre-admission clinic*

85 Gynaecological, anaesthetic and nursing staff should review relevant patients at a pre-admission  
86 clinic. Pre-admission clinics aspire to optimise patients' medical comorbidities and lifestyle factors.  
87 Such assessments have been shown to significantly lower cancellation rates.<sup>8</sup>

88

89 [Heading 3] Behavioural modification

90 Patients can make several behavioural modifications to improve their perioperative outcomes. For  
91 example, patients should abstain from smoking tobacco or consuming alcohol for 4 weeks  
92 preoperatively.<sup>2</sup>

93 As obesity becomes more prevalent, greater numbers of increasingly obese women will undergo  
94 gynaecological laparoscopy. Resultant anaesthetic challenges include accurately measuring  
95 patients' blood pressure, obtaining intravenous access, achieving regional techniques and the  
96 potential for difficult airway management and ventilation.<sup>9</sup> In addition to anaesthetic and  
97 mobilisation issues, coexistent cardiac, respiratory and metabolic complications add to the  
98 perioperative challenges presented. An individualised risk–benefit analysis should be undertaken  
99 and nonoperative alternatives encouraged. Some hospitals have stringent policies (e.g. no elective  
100 surgery if body mass index, BMI, is greater than 35 kg/m<sup>2</sup>); others require achievable weight loss  
101 (e.g. 5%) preoperatively.

102 Data from nongynaecological populations show that so-called 'prehabilitation' (i.e., preoperative  
103 exercise and physical conditioning) improves postoperative outcomes such as pain, length of stay,  
104 and physical function.<sup>10</sup>

105

106 [Heading 3] Patient education and expectation management

107 One vital component of ERAS programmes is preoperative counselling, which sets realistic  
108 expectations regarding surgical and anaesthetic recovery and postoperative patient care.<sup>2</sup>  
109 Preoperative education reduces anxiety, increases patient satisfaction, reduces pain and nausea  
110 and improves patient wellbeing.<sup>2</sup> Some trusts have found that so-called 'recovery schools' are an  
111 efficient way to impart such knowledge. Here, classroom-based sessions outline the benefits of  
112 exercise, improved nutrition, the ERAS approach and preoperative lifestyle modifications (e.g.  
113 cessation of alcohol and smoking).

114

115 [Heading 3] Management of venous thromboembolism and bleeding risk

116 Screen all patients for risk factors for both venous thromboembolism (VTE) and bleeding using the  
117 National Institute for Health and Care Excellence (NICE) risk assessment chart (provided as online  
118 supporting information).<sup>11</sup>

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119 NICE simply state that pharmaceutical thromboprophylaxis (e.g., 7 days of low-molecular-weight  
120 heparin, LMWH) is warranted for patients 'whose risk of VTE outweighs their risk of bleeding'.<sup>12</sup>  
121 Hence, using this guideline means that surgeons must employ their clinical judgement and take  
122 individual patient factors into account.

123 Patients on estrogen-containing contraception or hormone replacement therapy should consider  
124 ceasing it 4 weeks preoperatively; offer advice on alternative contraception or management of  
125 vasomotor symptoms.<sup>12</sup>

126 An alternative VTE risk assessment tool is the Caprini score, as recommended by the American  
127 College of Chest Physicians. As outlined in Figure 1, this scoring system evaluates VTE risk based on  
128 patients' inherent predisposing factors (e.g. thrombophilias), modifiable risk factors (e.g. smoking  
129 status) and planned operation (e.g. open versus laparoscopic surgery).<sup>13</sup>

130 The patient's individualised Caprini score then allocates them to one of six VTE risk groups (from  
131 lowest to highest VTE risk). Thereafter, this guides their thromboprophylaxis, as noted in Table 1.<sup>14</sup>  
132 While this provides more detailed guidance than NICE and is less reliant on surgeons' clinical  
133 judgement, it does not take into account patients' bleeding risk.

134 If patients require LMWH postoperatively, yet are having an operation that carries a higher risk of  
135 intra-abdominal haemorrhage (e.g. myomectomy), management should be discussed with a  
136 haematologist. Surgery may need to be delayed to allow management of modifiable risk factors.

137

### 138 [Heading 3] Patients with complex analgesic requirements

139 Patients with chronic pain syndromes, or who are dependent on controlled medications or illicit  
140 substances, require an individualised analgesic strategy devised in collaboration with a pain  
141 specialist.<sup>15</sup> Studies have found a 20.8–97.4% drop in postoperative narcotic use when ERAS  
142 protocols are implemented.<sup>3</sup> Realistic expectations regarding postoperative pain should be  
143 outlined: clinicians should not promise a pain-free postoperative course; rather, that aggressive  
144 analgesia will lower pain to a tolerable level.

145

### 146 [Heading 3] Patients with diabetes

147 One common comorbidity worth discussing is diabetes – see Box 1.

148

## 149 *[Heading 2] Preoperative investigations*

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150 Clinicians tend to order excessive tests preoperatively: only 0.0–2.8% of ‘routine’ tests influence  
151 patient management.<sup>17</sup> Only order tests that are clinically indicated; doing otherwise causes false  
152 positives, further delays and potential harm. Standardised guidelines for preoperative  
153 investigations should be used that are specific to the patient population and planned procedure.<sup>18</sup>

154 Such guidelines should consider these key attributes:

- 155 • Diagnostic efficacy –whether the test correctly identifies abnormalities
- 156 • Diagnostic effectiveness – whether the test changes the diagnosis
- 157 • Therapeutic efficacy – whether the test changes patient management
- 158 • Therapeutic effectiveness – whether the test changes patient outcomes.<sup>19</sup>

159 The more of these attributes a preoperative test has, the more worthwhile it is.

160 NICE guidance outlines that patients having ‘intermediate’ grade surgery (such as laparoscopy),  
161 with an American Society of Anesthesiologists (ASA) status of 1 or 2 should not routinely have a  
162 full blood count (FBC) taken preoperatively.<sup>18</sup> (Those with an ASA 3 or 4 plus cardiac, renal and/or  
163 diabetic comorbidities do warrant a preoperative FBC, however.) A ‘blood group and save’ is not  
164 warranted routinely prior to benign laparoscopy.

165 Patients with a history (or examination findings suggestive) of heavy menstrual bleeding warrant a  
166 preoperative serum haemoglobin test. Anaemia is an independent predictive risk factor for  
167 operative complications and death.<sup>20</sup> Serum haemoglobin ( $\pm$  C-reactive protein, CRP) should be  
168 tested at least 1 month preoperatively (in appropriate patients) to enable treatment, guided by  
169 the flowchart in Figure 2. If iron therapy is indicated, it can be given orally in divided daily doses;  
170 evaluate the response after 1 month of therapy. If oral iron is contraindicated, poorly tolerated or  
171 ineffective, consider intravenous iron infusion if rapid iron repletion is clinically important (e.g. less  
172 than 2 months until nondeferrable surgery).<sup>21</sup>

173 Preoperative electrocardiograms (ECGs) aim to detect underlying cardiac disease (e.g. arrhythmia  
174 or myocardial infarction) that will either alter anaesthetic plans and/or require the postponement  
175 of surgery. An ECG is rarely indicated prior to laparoscopy. NICE suggests that patients with an ASA  
176 of 1 do not need a preoperative ECG, those with an ASA of 2 do if they also have cardiovascular,  
177 renal, or diabetic comorbidities and those with an ASA of 3 or 4 do need an ECG.<sup>18</sup>

178 Chest radiography (CXR) is not recommended prior to surgery, unless the patient has a history of  
179 respiratory disease, or abnormal findings on respiratory examination. There is no age cut-off  
180 above which CXR is routine prior to benign laparoscopy.<sup>18</sup>

181

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182 *[Heading 2] Alterations to regular medications*

183 Sparse evidence is available to guide the management of patients' regular medications  
184 perioperatively. General principles include:

- 185 • To continue medications that will not impair the operation or anaesthesia, but will carry  
186 considerable risks if withdrawn (e.g. beta-blockers)
- 187 • To withhold medications that increase surgical or anaesthetic risk and are not essential for  
188 short-term quality of life (e.g. angiotensin inhibitors)
- 189 • (If a medication doesn't clearly fit either category above) to base decisions on surgical and  
190 anaesthetic considerations, plus the stability of the condition the medication is used to  
191 treat<sup>22</sup>

192 When in doubt, discuss the medication in question with the prescribing clinician.

193 Perioperative management of antithrombotic agents (e.g. aspirin, clopidogrel, warfarin) presents  
194 contradictory risks: withholding these medications increases thrombotic risk, while continuation  
195 increases perioperative bleeding. At pre-admission clinic, discuss such patients with a  
196 haematologist and consult national and local guidelines.<sup>23</sup>

197 Goh et al.'s recent review of perioperative management of women on oral anticoagulants and  
198 antiplatelet agents undergoing gynaecological procedures provides invaluable guidance to  
199 clinicians.<sup>24</sup> Of note, the authors classify all day case and inpatient surgery as carrying a major  
200 bleeding risk. Their recommendations regarding perioperative management for such 'high  
201 bleeding risk' patients are summarised in Table 2.

202 Surgeons must assess the risk of postoperative haemorrhage on an individual case-by-case basis.

203  
204 **[Heading 1] Immediately preoperative: day prior to and day of surgery**

205 Patients should shower or bathe, using soap, on the day before or the day of surgery, to decrease  
206 the risk of surgical site infection.<sup>25</sup>

207 All patients admitted for abdominal or pelvic surgery should receive mechanical  
208 thromboprophylaxis: either graduated compression stockings and/or intermittent pneumatic  
209 compression. This should be continued until their mobility is no longer considerably reduced from  
210 baseline,<sup>12</sup> or as recommended based on their Caprini score (outlined previously).<sup>14</sup>

211  
212 *[Heading 2] Bowel preparation and fasting*



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213 Mechanical bowel preparation (e.g. bisacodyl, sodium picosulfate) should not be routinely  
214 administered, even in patients with planned enteric resection (e.g. deeply invasive endometriosis  
215 with rectal involvement).<sup>26</sup> Data from several randomised controlled trials (RCTs) show that bowel  
216 preparation is not associated with improved intraoperative visualisation, bowel handling, or  
217 surgical ease and can cause patient distress and dehydration.<sup>27</sup>

218 Regarding fasting, mounting evidence supports solid food intake up to 6 hours preoperatively and  
219 clear fluids (in particular, a complex carbohydrate drink for patients without diabetes) up to  
220 2 hours preoperatively.<sup>2</sup> These interventions reduce preoperative thirst, hunger and anxiety and  
221 postoperative insulin resistance, thereby improving both patient experience and length of stay.<sup>28</sup>

222 The neuroendocrine response to surgery results in sodium and water retention, leading to a  
223 reduction in maintenance fluid requirements.<sup>29</sup> Hence, administration of preoperative intravenous  
224 fluids for fasting patients is not routinely indicated.

225

226 *[Heading 2] Pregnancy testing*

227 On the day of surgery, sensitively ask all women of childbearing potential (from menarche to  
228 2 years after regular menses) whether there is any possibility they could be pregnant. Perform a  
229 urinary pregnancy test (with the woman's consent) if there is any doubt.<sup>18</sup> Such screening is  
230 positive in up to 0.4% of tests and fulfils the criteria outlined in the 'preoperative investigations'  
231 section.<sup>30</sup>

232

233 *[Heading 2] Preoperative analgesia*

234 Preoperative analgesia improves postoperative pain levels, thereby decreasing postoperative  
235 opioid use. Administer the following oral analgesia to all laparoscopy patients, 1 hour  
236 preoperatively (unless a contraindication exists): 1 g paracetamol, 400 mg celecoxib or ibuprofen,  
237 and 600 mg gabapentin.<sup>2,26</sup>

238

239 **[Heading 1] Intraoperative management**

240 *[Heading 2] Preventing surgical site infections*

241 Surgical site infections (SSIs) are infections that occur within 30 days of an operation, at or near a  
242 surgical incision. Two-thirds of gynaecological SSIs are superficial incisional infections (e.g. skin or  
243 subcutaneous tissues).<sup>31</sup>

244 Laparoscopic operations that are not contaminated by the genitourinary or digestive tracts do not  
245 require antimicrobial prophylaxis; such operations include oophorectomy, ovarian cystectomy,  
246 tubal ligation, salpingectomy, myomectomy (irrespective of whether the endometrial cavity is  
247 breached) and excision of endometriosis (except with bowel resection).<sup>2,26</sup> Conversely, operations  
248 that are expected to become 'clean-contaminated' warrant intravenous antibiotics.<sup>26</sup> ('Clean-  
249 contaminated' refers to procedures that open a colonised viscous or cavity under surgical  
250 circumstances, thereby allowing the ascent of pathogens.) Examples of 'clean-contaminated'  
251 procedures include total hysterectomy (which incises into the vagina) and excision of severe  
252 endometriosis (which may necessitate contact with vaginal, vesical, and/or bowel mucosa).

253 If indicated, prophylactic antibiotics should have a spectrum of activity covering the most common  
254 infecting organisms and be at adequate concentrations from the time of knife-to-skin until the  
255 operation's completion. One evidence-based regimen is to administer 2 g cefazolin or 1.5 g  
256 cefuroxime, plus 500 mg metronidazole (all intravenous) during the hour prior to skin incision  
257 (increase doses in patients with a BMI greater than 30 and/or weight greater than 100 kg.<sup>26,32,33</sup>  
258 Broadening coverage by administering metronidazole (rather than a cephalosporin alone)  
259 decreases SSI following hysterectomy.<sup>33</sup> Alternatively, similar broad-spectrum coverage is  
260 achieved with intravenous amoxicillin plus a  $\beta$ -lactamase inhibitor (e.g. co-amoxiclav, at a dose of  
261 2 g amoxicillin/1 g clavulanic acid).<sup>2,25,30</sup> For patients who are allergic to penicillins or  
262 cephalosporins, administer a combination of clindamycin and gentamicin, or a quinolone (e.g.  
263 ciprofloxacin).<sup>26,32</sup> Antibiotics should be repeated if the operative time is longer than 3 hours  
264 and/or blood loss is greater than 1500 ml.<sup>32</sup>

265 Regarding skin and vulval or vaginal preparation: traditionally, povidone-iodine was used in the  
266 vagina owing to concerns about complications attributable to alcohol-based chlorhexidine.  
267 However, compared with povidone-iodine, chlorhexidine more effectively eliminates vaginal  
268 bacteria and remains effective in the presence of blood.<sup>31</sup> In concentrations of 4% or less, alcohol-  
269 based chlorhexidine is well-tolerated vaginally and its use is supported by the American College of  
270 Obstetricians and Gynecologists.<sup>26,34</sup> Hence, surgeons should use alcohol-based chlorhexidine (less  
271 than or equal to 4% alcohol content) for abdominal and vulval or vaginal preparation.

272 Adoption of SSI reduction 'bundles' decreases the risk of SSI. Elements of such bundles (which are  
273 additive) include antibiotic prophylaxis, skin preparation, and avoidance of hypothermia, surgical  
274 drains, and perioperative hyperglycaemia.<sup>2</sup>

275

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276 *[Heading 2] Intra-operative VTE prophylaxis*

277 All patients undergoing laparoscopy should have graduated compression stockings and/or  
278 intermittent pneumatic compression intra-operatively.<sup>12</sup>

279

280 *[Heading 2] Maintenance of normothermia and euvolaemia*

281 Heat loss is accelerated intra-operatively owing to abdominal exposure and preparation and  
282 impaired thermoregulatory responses secondary to general anaesthesia. Actively maintain  
283 normothermia using air blanket devices and warmed intravenous fluids.

284 Trendelenburg position and pneumoperitoneum reduce patients' cardiac output; hypovolaemia  
285 increases the risk of postoperative acute kidney injury, SSI, sepsis and prolonged hospital stay.<sup>2</sup>  
286 Hence, normovolaemia should be maintained, using stroke volume to guide intravenous fluid  
287 administration.

288

289 *[Heading 2] Intra-operative analgesia and wound closure*

290 There are mixed data about the postoperative analgesic benefits of administering local  
291 anaesthetic to the tissue surrounding laparoscopic port sites. However, given the limited risks and  
292 low cost involved, most surgeons do so. One recommended regimen is to use 0.25% bupivacaine  
293 (2.5 mg/ml), to a maximum dose of 2.5 mg/kg.<sup>35</sup>

294 Skilled wound closure is pivotal to minimising wound complications. Subcuticular absorbable  
295 sutures are most often used for closing laparoscopic port sites, but so called 'tissue glue' can be  
296 used as an alternative.<sup>36</sup>

297

298 **[Heading 1] Postoperative: in the recovery bay and/or ward**

299 *[Heading 2] Postoperative nausea and vomiting*

300 Postoperative nausea and vomiting (PONV) affects 30% of all patients following general  
301 anaesthesia.<sup>37</sup> The Apfel score assesses four variables (female gender, history of motion sickness  
302 and/or PONV, non-smoker and planned opioid treatment postoperatively) and assigns one point  
303 for each variable. The probability of PONV for scores of 0, 1, 2, 3, and 4 are 10%, 21%, 39%, 61%,  
304 and 78%, respectively.<sup>37</sup> Most women undergoing benign gynaecological laparoscopy are in the  
305 highest risk group (i.e. at almost 80% risk of PONV).<sup>37</sup> Hence, PONV should be pre-empted in  
306 gynaecological laparoscopy patients and multifaceted management should be routinely

307 implemented. This should include avoiding nitrous oxide and volatile anaesthetics where feasible,  
308 using a continuous target-controlled propofol infusion, utilising short-acting inhalational agents  
309 (e.g. sevoflurane or desflurane), minimising opioid use and using a lower neostigmine dose.<sup>2</sup>  
310 Routine prophylactic anti-emetics should be administered; a combination of two or more anti-  
311 emetic classes enhances potency (e.g. dexamethasone, plus aprepitant, ondansetron, midazolam  
312 or haloperidol).<sup>2</sup>

313

#### 314 *[Heading 2] Diet and bowel function*

315 Postoperatively, oral fluids and a regular ('full ward') diet can be commenced immediately.<sup>26,38</sup>  
316 This approach is safe and is associated with less nausea, shortened length of stay and higher  
317 patient satisfaction.<sup>26</sup>

318 Return to bowel-related functioning is an important factor indicating return to daily activities.  
319 Regular laxative use reduces the time to first defecation by 24 hours (from 69 to 45 hours).<sup>39</sup>  
320 Regular administration of laxatives is reasonable, given their favourable side-effect profile and low  
321 cost.

322

#### 323 *[Heading 2] Postoperative analgesia*

324 Mild pain is common following laparoscopy because carbon dioxide used to produce  
325 pneumoperitoneum can remain in situ, causing cramps, bloating and shoulder tip pain. These  
326 symptoms should subside within 24 hours, but if pain worsens thereafter, intra-abdominal  
327 complications must be excluded.<sup>40</sup>

328 Benefits of optimising analgesia include earlier mobilisation (decreasing VTE risk and pulmonary  
329 complications), improved sleep, higher patient satisfaction and fewer delayed discharges.  
330 Multimodal analgesia improves pain relief, while reducing the side-effects of individual agents.  
331 Administration of regular paracetamol and regular non-steroidal anti-inflammatory drugs reduces  
332 both pain and opioid consumption.<sup>2</sup> A weak opioid (e.g. codeine) can be added *pro re nata*.<sup>40</sup>

333 Opioids are associated with sedation, fatigue, restricted mobilisation, nausea and ileus, so  
334 minimising their use improves both the patient experience and functional recovery.<sup>2</sup> Evidence-  
335 based guidelines founded on patients' actual opioid use suggest that prescribing 15 x 5 mg  
336 oxycodone tablets after laparoscopic hysterectomy will meet or exceed 75% of patients' needs.<sup>41</sup>

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337 Prescribing any more than this may contribute to opioid dependence, which is a growing global  
338 problem.

339 Individual variability in patients' postoperative opioid consumption means that clinicians should  
340 consider patient factors such as preoperative opioid use and history of endometriosis.<sup>42</sup> Shared-  
341 decision making can further decrease opioid prescribing, without reducing patient satisfaction or  
342 postoperative pain control.<sup>43</sup>

343 Tapentadol (a relatively new medication) may become an alternative to oxycodone. Some studies  
344 have shown similar analgesic efficacy to oxycodone, with less nausea and constipation.<sup>44</sup> Further  
345 studies are needed to determine its role in post-laparoscopy analgesia.

346

347 *[Heading 2] Early mobilisation*

348 Early mobilisation is key to ERAS: it counteracts the numerous disadvantages of bed rest, such as  
349 VTE and impaired insulin resistance, pulmonary function and tissue oxygenation.<sup>28</sup> Encourage  
350 mobilisation by prescribing effective multimodal analgesia, eschewing drain tubes and removing  
351 hindrances (e.g. catheters and intravenous cannulae) as soon as possible.

352 The pace of resumption of normal activities postoperatively depends on the operation performed.  
353 Pragmatic advice is, 'if it hurts, don't do it'; patients should notice a daily improvement in the  
354 activities they can undertake without pain.<sup>40</sup> Time until return-to-work depends on the patient's  
355 operation and occupation: 2 weeks of leave from a sedentary job after laparoscopy usually  
356 suffices. For 2 weeks postoperatively, patients should avoid lifting anything heavier than a full  
357 kettle and any considerable pushing and pulling activities (e.g. lawn-mowing, vacuuming).<sup>40</sup>  
358 Patients should not drive until they are no longer using opioids or other sedatives, have sufficient  
359 reaction times and can comfortably apply the brakes forcibly and check their blind spot.<sup>40</sup>

360

361 *[Heading 2] VTE prophylaxis*

362 Patients should mobilise as soon as possible postoperatively. Additional thromboprophylaxis is  
363 guided by their individualised VTE risk assessment, as outlined previously.

364 If LMWH is indicated, then prior to administering the first dose, evaluate the likelihood of bleeding  
365 by reviewing the NICE bleeding risk assessment tool, operation notes, output from drain tubes (if  
366 present) and ooze on surgical dressings.<sup>11</sup>

367 Any tick in the 'bleeding risk' section of the NICE risk assessment tool should prompt clinicians to  
368 consider if the patient's higher risk of bleeding precludes LMWH administration.<sup>11</sup> If so, discuss the  
369 patient with their surgeon and a haematologist. Some situations may warrant unfractionated  
370 heparin, which can be quickly reversed with protamine.

371 If at low risk of bleeding, administer LMWH within 12 hours postoperatively.<sup>45</sup> Consider admitting  
372 patients overnight if they require LMWH; this allows for clinical observation (subtle signs of intra-  
373 abdominal haemorrhage may not be recognised at home until considerable morbidity occurs).

374 If patients fly within 1 month of their operation, it would be sensible for them to wear graduated  
375 compression stockings.<sup>40</sup>

376

377 *[Heading 2] Management of urinary catheters*

378 Clinical guidelines regarding the management of urinary catheters after laparoscopy are sparse.  
379 Unless the patient has had a concomitant incontinence and/or prolapse procedure and/or has a  
380 history of urinary retention, their catheter should be removed at the end of their operation.

381 Regarding laparoscopic hysterectomy: guidelines from neither the UK nor USA provide  
382 recommendations on when to remove the urinary catheter.<sup>46,47</sup> An RCT of immediate versus  
383 delayed (18–24 hours postoperative) catheter removal following laparoscopic hysterectomy found  
384 that 4% of women in the immediate removal group had voiding dysfunction at 9 hours  
385 postoperatively.<sup>48</sup> The authors concluded that the clinical advantages of immediate catheter  
386 removal after uncomplicated laparoscopic hysterectomy outweigh the risk of urinary retention;  
387 this is consistent with an earlier RCT.<sup>49</sup>

388 Patients who have had a minor procedure (e.g. diagnostic laparoscopy, tubal ligation, ovarian  
389 cystectomy, excision of minimal/mild endometriosis), are at even lower risk of postoperative  
390 urinary retention (POUR). (POUR refers to impaired voiding after a procedure, despite a full  
391 bladder, which results in an elevated post-void residual, PVR.)<sup>50</sup> These patients do not even need  
392 to void prior to discharge, let alone undertake a formal 'trial of void'.

393 Women who have undergone concomitant incontinence and/or prolapse surgery and/or have a  
394 history of urinary retention, are at higher risk of POUR. These women do require a formal 'trial of  
395 void' prior to discharge. This involves asking the patient to void into a collection device when they  
396 have a strong urge, or after 4 hours have passed. The voided volume is measured, as is the PVR (by  
397 ultrasound). 'Success' is defined as the PVR being 100 ml or less, or the patient being able to void  
398 at least two-thirds of their total bladder volume (when total bladder volume = voided volume +

399 PVR).<sup>50</sup> If a patient does not pass on the first attempt, they can try again (when they have another  
400 strong urge or 4 hours later). If they do not pass on the second attempt, their trial of void is  
401 considered to be unsuccessful. They should be discharged with an indwelling catheter and the trial  
402 of void repeated 1 week later.

403

404 *[Heading 2] Postoperative investigations*

405 Postoperative investigations are rarely indicated. When necessary, they should be guided by the  
406 patient's comorbidities and clinical state. A full blood count is only warranted for patients who  
407 have symptoms and/or signs of haemodynamic compromise.<sup>51</sup>

408

409 **[Heading 1] Advice upon discharge**

410 Discharge patients once they are mobilising, tolerating fluids and controlling their pain with oral  
411 analgesia. Although desirable, passing urine and flatus and tolerating oral intake are not  
412 prerequisites for discharge.<sup>40</sup> Prescribe a softening laxative (e.g. docusate) to take until their first  
413 bowel movement.

414 Patients should be advised when to seek clinical review; for example, if their abdominal pain  
415 worsens or if there is worsening distension; if they are unable to eat, drink, or mobilise; or if they  
416 experience nausea or vomiting, poor urine output or fever. Of note, almost all fevers that occur on  
417 day one are unexplained, with virtually all resolving by day four. Such febrile episodes are thought  
418 to be associated with direct tissue trauma and the resultant release of pyrogenic cytokines. Hence,  
419 a 'less is more' approach is generally appropriate. Conversely, fevers beginning three or more days  
420 after surgery often have an infectious aetiology and warrant investigation (e.g. physical  
421 examination, urinalysis, full blood count, urine or blood culture, ultrasound and/or computed  
422 tomography) and broad-spectrum intravenous antibiotics (if infection is confirmed).<sup>52</sup>

423

424 **[Heading 1] Conclusion**

425 Evidence-based perioperative management and ERAS should be the standard of care in  
426 gynaecological laparoscopy.<sup>15</sup> Such an approach has many benefits, including decreased  
427 cancellation rates, higher patient satisfaction, fewer complications and shorter length of stay.  
428 Despite the evidence base supporting an ERAS approach to gynaecological laparoscopy, diffusion

## Life in the laparoscopic fast lane

429 and uptake of many interventions has been slow. Possible reasons include clinicians being  
430 unaware of, or unwilling to adopt, the interventions supported by evidence-based literature.

431 Simple measures that clinicians can implement include judicious ordering of preoperative  
432 investigations, screening for BV prior to laparoscopic hysterectomy, calculating each patient's VTE  
433 risk and implementing appropriate management thereafter, minimising preoperative fasting, only  
434 prescribing antibiotic prophylaxis and urinary 'trial of void' when indicated and prescribing  
435 multimodal analgesia. Such interventions will safely enhance patients' recovery and allow them to  
436 experience life in the laparoscopic fast lane.

437

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- 580

581 **Box 1. Perioperative management for women with diabetes**

582 The perioperative milieu challenges glycaemic management owing to fasting, counter-regulatory  
583 hormones released in response to the physiological stress of surgery and a slow return to normal

584 diet. Hence, patients often require considerable modifications to their medications. Unfortunately,  
585 there is neither a strong evidence base, nor a generic recipe for doing so: management should be  
586 based on national and local guidelines and conducted in discussion with an endocrinologist.<sup>16</sup> The  
587 following need consideration:

- 588 ▪ Patient's type of diabetes
- 589 ▪ Planned surgery
- 590 ▪ Presence or absence of diabetic complications
- 591 ▪ Patient's preoperative HbA1c levels (see below)
- 592 ▪ Withholding oral hypoglycaemic agents, which may need to be done for 24–48 hours  
593 preoperatively
- 594 ▪ Alterations to insulin dosing<sup>16</sup>

595 Endeavour to achieve an HbA1c of less than 69 mmol/mol (less than 8.5%) preoperatively.<sup>16</sup>  
596 Patients with an HbA1c greater than 69 mmol/mol should be discussed with the diabetes team  
597 and, if it is safe to delay surgery, their HbA1c should be optimised. The perioperative risks of  
598 proceeding when HbA1c is suboptimal should be balanced against the urgency of the procedure.

599 On the day of surgery, patients with diabetes requiring medications should be first on a morning  
600 list so as to minimise the duration of fasting: management becomes more complex as the day  
601 progresses. Patients with insulin-controlled diabetes should not undertake carbohydrate loading  
602 preoperatively. Target preoperative capillary blood glucose is 6–10 mmol/L; up to 12 mmol/L may  
603 be acceptable.<sup>16</sup> Higher blood glucose levels require measurement of urinary or capillary blood  
604 ketones: if urinary ketones are greater than +++, or capillary blood ketones greater than 3 mmol/L,  
605 then surgery should be cancelled and the on-call diabetes team contacted. If ketones are below  
606 these levels, administer rapid-acting insulin and recheck the blood glucose 1 hour later. If surgery  
607 cannot be delayed, or if the response is inadequate, commence a variable rate intravenous insulin  
608 infusion ('sliding scale').<sup>16</sup>

609 Intraoperatively, the frequency of capillary blood glucose level monitoring is determined by clinical  
610 circumstances; blood sugar should be measured at least hourly.<sup>16</sup> Aim for a blood sugar level of  
611 8 mmol/L (range 6–10 mmol/L; up to 12 mmol/L may be acceptable).<sup>16</sup>

612 Postoperatively, endeavour to maintain blood glucose levels between 6 and 10 mmol/L.  
613 Recommence oral hypoglycaemic agents once patients can eat and drink.

614

615

616 **[Heading 1] Figure legends**

617 Figure 1. Caprini score for venous thromboembolism risk stratification.<sup>13</sup>

618 Figure 2. Algorithm to guide management of preoperative anaemia.<sup>21</sup>

619 CRP = C-reactive protein; FBC = full blood count; GI = gastrointestinal; Hb = haemoglobin; MCH =  
620 mean corpuscular haemoglobin; MCV = mean corpuscular volume; UEC = urea, electrolytes and  
621 creatinine

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Table 1. Management of postoperative risk of venous thromboembolism based on patients' Caprini score

Caprini score	Risk category	VTE risk	Early frequent ambulation	Pneumatic compression devices	Graduated compression stockings	LWMH or low dose heparin	Duration
0	Lowest	Minimal	✓	± ✓ or	✓	✗	During hospitalisation
1–2	Low	Minimal	✓	✓ ±	✓	✗	During hospitalisation
3–4	Moderate	0.7%	✓	✓ ±	✓	✗	During hospitalisation
5–6	High	1.8%	✓	✓	✓	✓	7–10 days in total
7–8	High	4.0%	✓	✓	✓	✓	7–10 days in total
≥9	Highest	10.7%	✓	✓	✓	✓	30 days in total

LMWH = low-molecular-weight heparin; VTE = venous thromboembolism

**Table 2.** Commonly used oral anticoagulants and antiplatelet agents and recommendations of perioperative management for laparoscopy.<sup>24</sup>

Class, examples	When should it be stopped preoperatively?	When should it be restarted postoperatively?
<b>Vitamin K antagonist</b>		
Warfarin	5 days prior to elective surgery, with INR check ideally the day before surgery (if INR >1.5 phytomednadione should be given) and on the day of surgery.  Bridging with treatment dose LMWH should be considered in those with high VTE risk.	LMWH should not be given until 48 hours after surgery.  Restart warfarin when bleeding risk is minimised.  LMWH should be continued until INR in therapeutic range.
<b>Factor Xa inhibitors</b>		
Apixiban, rivaroxaban, edoxaban	Creatinine clearance ≥30 ml/min: stop 48 hours prior Creatinine clearance <30 ml/min: stop 72 hours prior	Wait 48 hours before re-introducing at the full dose. If high VTE risk, consider prophylactic dose of anticoagulation before restarting at full therapeutic dose.
Dabigatran	Creatinine clearance ≥80 ml/min: stop 48 hours prior Creatinine clearance ≥50 to <80 ml/min: stop 72 hours prior  Creatinine clearance ≥30 ml/min to <50 ml/min: stop 96 hours prior	Wait 48 hours before re-introducing at the full dose. If high VTE risk, consider prophylactic dose of anticoagulation before restarting at full therapeutic dose.
<b>COX inhibitor</b>		

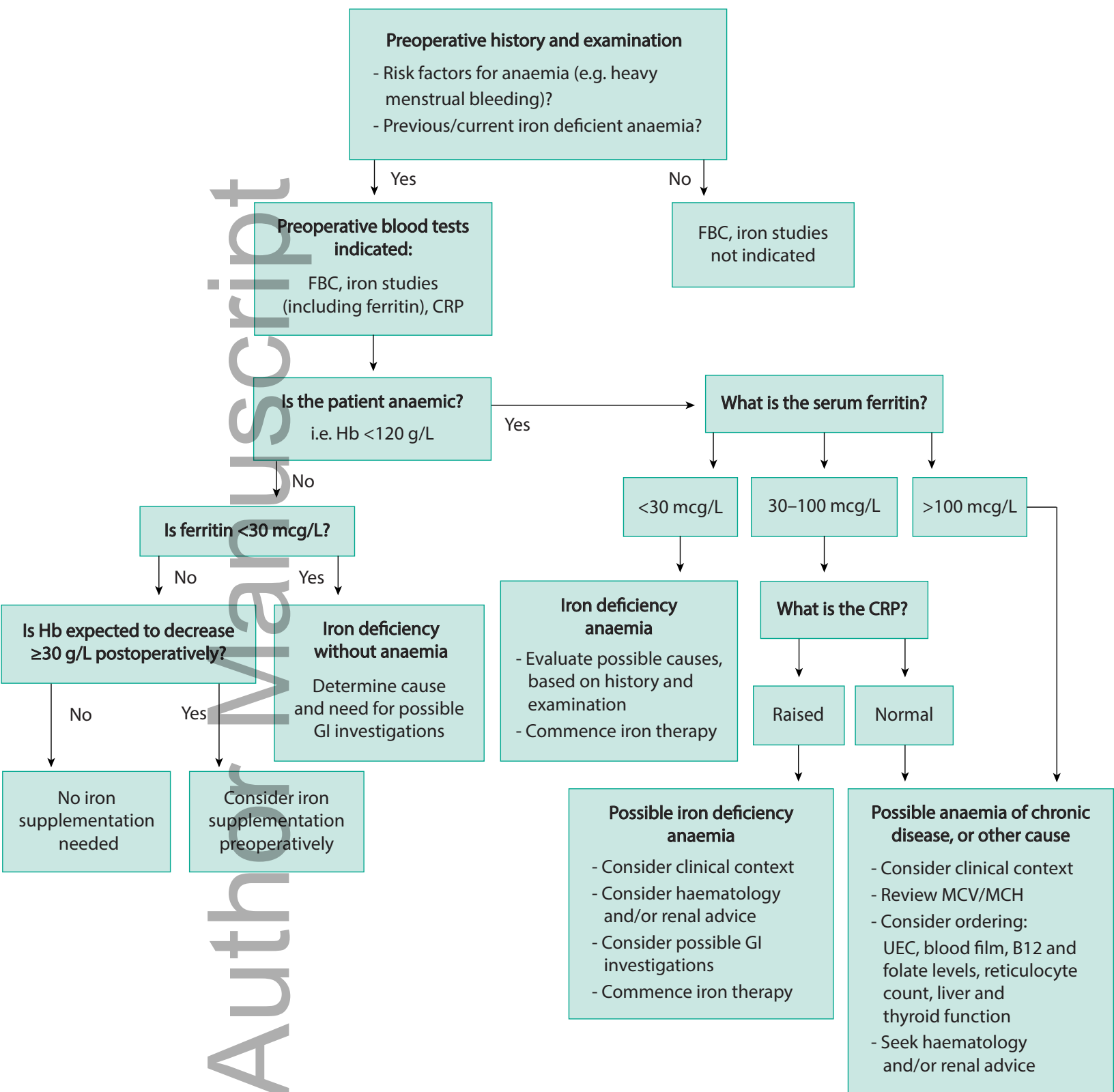


Aspirin	Continue	Continue
<b>P2Y12 inhibitors</b>		
Clopidogrel, prasugrel, ticagrelor	In patients with recent coronary syndrome or coronary artery stent on dual antiplatelet therapy: if possible, postpone the surgery; if not possible, stop medication 7 days before and continue with aspirin following liaison with haematologist.	Restart when haemostasis achieved (12–24 hours post-surgery).

INR = international normalised ratio; LMWH = low-molecular-weight heparin; VTE = venous thromboembolism

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1. Patient's age is:
  - 0–40 years (**0 points**)
  - 41–60 years (**1 point**)
  - 61–74 years (**2 points**)
  - 75 years or older (**3 points**)
  
2. Add **1 point** for each statement that applies:
  - Surgery under general / regional anaesthesia that lasted more than 45 minutes in the last month
  - Varicose veins (within the last month)
  - Swollen legs (within the last month)
  - Heart attack (within the last month)
  - Serious infection (e.g. pneumonia, cellulitis) within the last month
  - Inflammatory bowel disease (in the past / currently)
  - Congestive heart failure (in the past / currently)
  - Chronic lung disease (e.g. chronic obstructive pulmonary disease), NOT including asthma
  
3. For women only, add **1 point** for each statement that applies:
  - Currently on hormonal contraception (pills, implants, patches, intrauterine device or injection) or hormonal replacement therapy
  - Currently pregnant
  - Had a baby within the last month
  - History of unexplained stillbirth, more than three miscarriages, preterm birth with pre-eclampsia, or low birth weight baby
  
4. Add **2 points** for each statement that applies:
  - Patient previously told that they have cancer, leukaemia, lymphoma, or melanoma
  - In the last month, the patient has had a plaster cast or mold that has limited leg bending / walking normally
  - In the last month, the patient has had a PICC line, port, or central venous access catheter inserted in their neck or chest
  
5. Add **3 points** for each statement that applies:
  - Previous blood clot in legs, arms, abdomen or lungs
  - Family history of blood clots
  - Patient has previously been told they have increased risk of clotting based on blood tests
  
6. Please select the appropriate statement for the patient:
  - In bed for less than 3 days when unable to walk more than 30 feet (add **1 point**)
  - In bed for 3 days or more when unable to walk more than 30 feet (add **2 points**)
  
7. Add **5 points** for each of these statements that applies:
  - Hip or knee replacement surgery within the last month
  - Broken hip, pelvis or leg within the last month
  - Serious trauma (e.g. multiple broken bones due to fall or car accident) within the last month
  - Spinal cord injury resulting in paralysis within the last month
  - Stroke (clot or haemorrhage in the brain, or transient ischaemic attack) within the last month
  
8. If the patient is scheduled for surgery, please select the most appropriate statement:
  - Scheduled surgery is under general or regional anaesthesia and is expected to take less than 45 minutes (**add 1 point**)
  - Scheduled surgery is under general or regional anaesthesia and is expected to take more than 45 minutes, including laparoscopy (add **2 points**)



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