

## DAYCASE LAPAROSCOPIC GYNAECOLOGICAL PROCEDURES- CURRENT TRENDS IN ANAESTHETIC MANAGEMENT

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### ABSTRACT

Laparoscopy for gynaecological procedures is minimally invasive and is mostly performed as a daycase. The advancement of laparoscopy and minimal access surgery has greatly influenced the evolution of anaesthetic techniques. Preoperative assessment can be simplified by the use of questionnaires in pre-assessment clinics. Intraoperative intravenous fluid administration improves patient well being while airway management can be by the age-old, tried and trusted orotracheal tube or by the newer laryngeal mask airways. The use of propofol as an induction agent, a short acting non-depolarizing muscle relaxant e.g. mivacurium, an inhalational anaesthetic agent with a fast wake up time e.g. sevoflurane or desflurane, and short acting opioids e.g. fentanyl guarantees quick recovery of patients. The trend towards a multimodal approach to postoperative pain and prevention of postoperative nausea and vomiting (PONV) improves postoperative profile of day case gynaecological patients. Expertise in providing a pneumoperitoneum with carbon dioxide is desirable even as other options for lifting the abdominal wall are being investigated.

**Key Words:** Gynaecological Laparoscopy, Daycase, Anaesthesia, Current trends. *(Accepted 3 July 2008)*

### INTRODUCTION

There has been an impressive advancement in laparoscopic techniques since its introduction in the 20th century<sup>1,4</sup>. Laparoscopy, initially used for diagnostic purposes, has been expanded to include operative surgery and currently, is widely and popularly used for daycase laparoscopic procedures. The morbidity and mortality initially associated with laparoscopy has greatly reduced over the years as a result of improved skills and modern technology<sup>2</sup>. There is also an improvement in the management of postoperative pain and in the actions that are taken to prevent potential complications such as nausea and vomiting, dizziness, delayed mobilization as well as pulmonary and haemodynamic disturbances. Laparoscopic procedures may soon become routine in a number of teaching hospitals in Nigeria because some of them were recently equipped with high resolution video cameras and television monitors via the VAMED project of the Federal Government of Nigeria<sup>5</sup>. This article presents current anaesthetic management; describes laparoscopic gynaecological procedure; addresses patient selection, anaesthetic implications, perioperative anaesthetic management and the anaesthetic agents and adjuvants currently available for daycase laparoscopic procedures.

### PATIENT SELECTION AND PREOPERATIVE ASSESSMENT

Laparoscopic gynaecological procedures such as

bilateral clip sterilization and dye test are standard daycase procedures. Not all patients are suitable for daycase surgery, no matter how 'minimally invasive' the surgery may be. For example, ovarian cystectomy for the removal non-cancerous cysts can be performed laparoscopically but the average hospital stay is 3-7 days. Only American Society of Anesthesiology (ASA) Class I or II patients are preferred for daycase procedures because they tolerate better the physiological effects of carbon dioxide pneumoperitoneum and the variations in positioning when compared with ASA III and IV patients<sup>6</sup>. In addition, the presence of pre-existing diseases which may be seen in ASA III and IV patients has been associated with a higher risk of perioperative morbidity and mortality. For example asthma has been associated with respiratory events; hypertension with cardiovascular complications; and gastroesophageal reflux disease with adverse intubation events<sup>7</sup>. Some hospitals well established for daycase surgery, may have a daycase unit (DCU) dedicated for the reception and the general care of their patients. The advantage is that daycase surgery and anaesthesia can be developed as a sub-specialty. Irrespective of the type and structure of the daycase unit, there is still a need for a well established inpatient facility for managing patients when complications occur. Moreover, high risk patients that require laparoscopy can be admitted and managed as in-patients. Preoperative assessment of patients for daycase laparoscopic procedures can be performed by using assessment forms or computerized questionnaires to obtain information about the patient's medical condition, previous operations, drug and family history and also to provide a general review of

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systems. Pre-assessment clinics could be consultant-led and nurse-run<sup>8</sup>. Routine preoperative test is unnecessary in this group of patients but hemoglobin test is essential in women below the age of 40. This is to exclude anaemia that can result from monthly menstruation and from postpartum haemorrhage.

## **PROCEDURE AND ANAESTHETIC IMPLICATIONS**

Laparoscopic procedures require the creation of a pneumoperitoneum and a steep Trendelenburg position in order to visualize the pelvic structures. Both actions have anaesthetic implications. With the use of the laparoscope (fine telescope), instruments are passed into the abdomen to enable the gynaecologist to operate. The operative field can be visualized by high resolution television camera. At the end of the operation, the abdomen is deflated and a stitch is placed in the small wound. Carbon dioxide pneumoperitoneum produces pulmonary and haemodynamic disturbances that are worse in the spontaneously breathing patient. A head down (Trendelenburg) position causes both splinting of the abdomen and reduction of the functional residual capacity. The patient undergoing laparoscopy is thereby prone to hypoxaemia and hypercarbia<sup>9,10</sup>. Hypercarbia may stimulate the sympathetic nervous system resulting in an increase in the heart rate with the possible risk of arrhythmia. Other effects of carbon dioxide pneumoperitoneum include an increased mean arterial pressure, systemic vascular resistance (SVR), and increase in central venous pressure with resultant decrease in cardiac output and stroke volume. In order to avoid these problems, a general anaesthetic using a relaxant technique with effective mechanical ventilation of the lungs is preferred. However being a relatively short procedure, it is essential that the drugs administered must have a quick onset and offset. The use of local anaesthetics as the sole agent for laparoscopic procedures must be discouraged because of the associated awareness and anxiety produced in the patient. It may be particularly distressing for the patient when placed head down and during the creation of a pneumoperitoneum thereby worsening the haemodynamic disturbances.

## **INTRAVENOUS FLUIDS**

Venous access must be established for the administration of the intravenous drugs and for the possible administration of fluids or vasopressors when required. Intravenous fluids are not usually required because commonly, there is no associated fluid or blood loss during laparoscopic procedures. However, preoperative administration of 2ml/kg of sodium lactate infusion for every hour of fasting has been found to reduce PONV and post operative pain in high risk patients presenting for gynecologic laparoscopy<sup>11</sup>.

## **MONITORING**

Irrespective of the duration of surgery and anaesthesia, all patients must be monitored and treated based on evidence. Patient's physiological state and depth of anaesthesia need continuous assessment perioperatively. Clinical observations of patient's mucosal colour, pupil size, and response to surgical stimuli, chest wall movements, palpitations of pulse as well as auscultation of breath sounds must be combined with the use of the recommended standard monitoring devices<sup>12</sup>. The monitoring devices essential to the safe conduct of anaesthesia include the pulse oximeter, non-invasive blood pressure monitor, electrocardiograph, capnograph for airway gases: oxygen, carbon dioxide and vapour as well as airway pressure.

## **AIRWAY MANAGEMENT**

The cuffed orotracheal tube (COTT) remains the safest, time tested technique of airway management during laparoscopy and is the yardstick for measuring the efficacy of other airway devices<sup>13</sup>. It protects the airway better from the risk of regurgitation that may result from increased intra-abdominal pressure during in-sufflation. Inadvertent endobronchial intubation which may occur intraoperatively from changes in patient positioning, especially with the introduction of pneumoperitoneum and trendelenburg positioning must be prevented<sup>14</sup>. Fortunately, this can be detected by increased airway pressure and desaturation, early in the procedure, without an increase in end tidal carbon dioxide. The laryngeal mask airway (LMA) provides an alternative to ventilation through a cuffed orotracheal tube. It is easier to insert and does not require muscle relaxants for insertion<sup>15</sup>. Its use is contraindicated in patients with pharyngeal pathology and obstruction, full stomach, high airway resistance (e.g. bronchospasm) as well as low pulmonary compliance (e.g. obesity). The misgivings about the safety of the LMA include partial protection of the larynx from pharyngeal secretions; malfunction, if not properly inserted resulting in gastric distention and regurgitation; and failure as a result of down folding of the epiglottis or the distal cuff<sup>15,16</sup>. All these can be prevented or minimized by proper insertion. However, the LMA is not safety-proof for gastric regurgitation therefore; safety precautions must be taken, such as, inflating the cuff with the correct amount of air and ensuring adequate depth of anaesthesia. Pharyngeal suctioning and cuff deflation must be avoided until the patient is awake and has regained full airway control. The LMA has been successfully used in a large number of gynecological laparoscopic procedures<sup>14,15</sup>. The use of a newer supraglottic airway device i.e. the cobra perilaryngeal airway (PLA) for controlled ventilation during gynaecological laparoscopy is a potential alternative to the OTT and LMA<sup>17</sup>. The "oesophageal-tracheal combitube has a distal cuff which can be

placed in the oesophagus for aspiration protection during prolonged laparoscopic surgery but this is more costly than the orotracheal tube and does not provide an added advantage for the short daycase procedures<sup>18</sup>.

## **INDUCTION AND MAINTENANCE OF ANAESTHESIA**

Propofol is the preferred induction agent for daycase laparoscopic procedures because of improved postoperative recovery and faster recovery of consciousness when compared with thiopentone<sup>19</sup>. It depresses airway reflexes more potently than thiopentone. Propofol has also been shown to result in a reduction in the incidences of nausea and vomiting thereby reducing the requirement for the use of antiemetics<sup>20,21</sup>. Propofol and low dose (1-2 ug/kg) fentanyl capitalize on the hypnotic and analgesic property of each drug, respectively. The combined use of propofol and opioids, notably fentanyl and alfentanil, may be associated with a transient bradycardia and hypotension; however this is balanced by the opposing effect of carbon dioxide pneumoperitoneum. The mu-receptor ultrashort acting agonist, remifentanyl, is popularly used for daycase gynaecological surgery. Remifentanyl undergoes hydrolytic metabolism by blood and tissue esterases and this ensures a rapid termination of the drug effect. Because of its rapid clearance and blood-brain equilibration time of 60-90 seconds, it is administered as an infusion in the busy outpatient setting allowing for fast-tracking and bypassing of the recovery room (post anaesthesia care unit<sup>22</sup>. Volatile induction and maintenance of anaesthesia (VIMA) with sevoflurane provides a smooth transition from induction to maintenance phase. Of the entire currently available volatile anaesthetic agents, sevoflurane is the least irritating to the respiratory tract and in addition provides a fast wake-up time because of its low blood/gas partition coefficient of 0.69 making it the preferred inhalational anaesthetic for daycase. The other volatile agents namely halothane, isoflurane and enflurane may be used but must be turned off on time to avoid prolongation of recovery. Although, desflurane like sevoflurane has a fast wake up time, it is irritating to the respiratory tract and is thus preferred for maintenance alone. There is a significant postoperative nausea and vomiting rate with VIMA even where opioids are omitted<sup>23</sup>. Nitrous oxide should be used with caution as an adjuvant for inhaled anaesthesia because it may accumulate in the carbon dioxide pneumoperitoneum and worsen the consequences of gas embolism. It can also introduce a fire risk. The use of oxygen in air provides a safer option.

## **MUSCLE RELAXATION**

The ideal muscle relaxant for daycase procedures should provide adequate paralysis within a clinically acceptable time of onset (<3min), be capable of rapid pharmacological antagonism if required, have minimal side effects, be non-cumulative on repeat dosing and have a short duration of action of about 15-20 min. Daycase laparoscopy demands greater flexibility in the use of a muscle relaxant than do most other operations, since the operating time can vary from 10 minutes to 45 minutes or more and the completion of the operation can be relatively sudden and unexpected. The administration of the short acting depolarizing muscle relaxant (e.g. suxamethonium) using an infusion pump and titrating it as required, while providing ideal conditions, has drawbacks. These include postoperative muscle pain, the risk of phase 2 block with higher doses, the rare problem of atypical plasma cholinesterase, and the rare association of malignant hyperthermia<sup>24</sup>. The intermediate non-depolarizing muscle relaxants such as vecuronium, atracurium, cis-atracurium, rocuronium and mivacurium possess many of the ideal characteristics. Mivacurium has the shortest duration of action of all the currently used non-depolarizing agents and recovery from it is more rapid. Furthermore, it does not require pharmacological antagonism. Though it is metabolized by human plasma cholinesterase like suxamethonium, the myalgia, hyperkalaemia, bradycardia, and problems of phase 2 block that may be associated with suxamethonium are not seen with mivacurium<sup>25</sup>. Rapacurium offered an excellent neuromuscular profile for short surgical procedures needing muscle relaxation but has been withdrawn because of its undesirable respiratory side effects i.e. increased airway pressure and bronchospasm<sup>26</sup>.

## **ANTI-EMESIS**

The use of an anti-emetic reduces the risk of nausea and vomiting, irrespective of the anaesthetic agents used. Postoperative nausea and vomiting (PONV) is a complication seen in 70% of patients undergoing gynaecological laparoscopic procedures and thus a major concern<sup>27</sup>. Different anti-emetics given on their own have shown different results in the past. Ondansetron was found to be 80% more effective when compared with droperidol and prochlorperazine<sup>28</sup>. A clinical trial carried out by Fujii et al<sup>29</sup> reported complete control of nausea or vomiting in 88% of the granisetron group, droperidol 60% and metoclopramide 55%. The available 5-HT<sub>3</sub> receptor antagonists i.e ondansetron, granisetron, dolasetron and tropisetron are not different in efficacy or side-effect profile when appropriate doses were used for the management of PONV<sup>30</sup>. Midazolam, a water soluble benzodiazepine has been established to have anti-emetic properties. Midazolam premedication

effectively reduces the frequency of PONV in patients undergoing daycase surgery<sup>31</sup>. A recent comparison of Midazolam with ondansetron confirmed that Midazolam 2mg given intravenously before the end of surgery was as effective as ondansetron 4mg in decreasing PONV<sup>32</sup>. Although ondansetron is now generic and the cost has come down significantly, it is still about ten times the cost of midazolam, making midazolam a cost effective choice. There is a growing trend towards the use of combination antiemetic therapy. For example the risk of PONV was shown to be reduced when cyclizine and granisetron were given together than with either given alone<sup>33</sup>. The combined use of ranitidine and metoclopramide for premedication is cost effective and produces excellent antiemetic effect. This is because ranitidine decreases acidity of gastric secretion<sup>34</sup> while metoclopramide increases the lower oesophageal sphincter (LOS) tone, speeds gastric emptying and lowers gastric fluid volume. Because PONV has a multifactorial etiology, the use of a combination of agents, acting on different receptors and the adoption of a multimodal approach may achieve a significant improvement in the management<sup>35,36</sup>. Droperidol, a buterophenone used in anaesthesia as an antiemetic was associated with QTc segment prolongation and/or *torsades de pointes*, which in some cases resulted in fatal cardiac arrhythmias<sup>37</sup>. However, the UK Medicine Control Agency (MCA) has allowed the continued acute use of droperidol in anesthesia and as an antiemetic. A recent study compared premedication with transdermal scopolamine (TDS) with droperidol and ondansetron for antiemetic prophylaxis as part of a multimodal regimen. This showed that scopolamine 1.5mg was as effective as droperidol 1.25mg IV or ondansetron 4mg IV in preventing nausea and vomiting in the early and late postoperative periods. However, the use of a TDS patch is more likely to produce a dry mouth<sup>38</sup>.

### **PNEUMOPERITONEUM**

The creation of a pneumoperitoneum allows the surgeons to visualize the abdominal viscera. Carbon dioxide has high blood solubility and this allows easy excretion of absorbed gas via the lungs, as well as minimizing the effects of gaseous embolization. It is also non-combustible allowing for the use of cautery. To avoid the build up of nitrous oxide in the pneumoperitoneum, external venting of the dangerous peritoneal gas mixture and compensation by fresh carbon dioxide can be performed in a calibrated and constant manner<sup>39</sup>. The use of nitrous oxide, air and oxygen for creating a pneumoperitoneum has been abandoned because of their ability to support combustion. Inert gases such as helium and argon were experimented upon because of their non-combustibility and lack of

abdominal irritation. Unfortunately, these gases are extremely insoluble and can create potential problems with the occurrence of gaseous emboli<sup>40</sup>. The abdominal wall retractor is an innovation, which lifts the abdominal wall allowing visualization of the viscera without use of a pneumoperitoneum<sup>41</sup>. The use of this retractor avoids the problems of decreased pulmonary compliance and lung volumes, avoids the carbon dioxide load, and minimizes changes in venous return and systemic venous resistance. A study by Pelosi on 72 consecutive patients using the abdominal retractor reported ease of use and excellent surgical exposure without wound related complications<sup>42</sup>.

### **POSTOPERATIVE PAIN AND ANALGESIA**

Despite the minimal invasiveness of laparoscopic procedures, patients do experience some postoperative pain. Innervation of the fallopian tubes is almost entirely under the control of autonomic nerves. Parasympathetic cholinergic stimulation acts via intramural muscarinic receptors to increase smooth muscle tone. In general, smooth muscle spasm is clinically associated with diffuse, colicky pain. The contribution of the cholinergic system is supported by evidence that the anticholinergic agent glycopyrrolate decreased the incidence of pain following this procedure and that the pain is spasmodic in nature<sup>43</sup>. Buscopan (hyoscine N-butylbromide), an anticholinergic agent used commonly in the treatment of smooth muscle spasm of biliary and urogenital origin, has been shown not to have an analgesic effect following laparoscopic sterilization with Filshie clips<sup>44</sup>. Amongst the anticholinergics, glycopyrrolate is the most suitable agent against pain induced by tubal spasm<sup>45</sup>. The pain of laparoscopic sterilization is greater than that after laparoscopy alone. This is due to the clips or rings applied on the fallopian tubes, which induces ischaemia or spasm. Rings tend to cause more pain than clips suggesting that the major cause of pain enhancement is tubal spasm<sup>46</sup>. Other causes of pain are peritoneal irritation by blood from the trauma and shoulder tip pain referred from the diaphragm. Systemic analgesia (tramadol and co-dydramol) may provide adequate postoperatively pain relief. Non-steroidal anti-inflammatory drugs (e.g. ketorolac and diclofenac sodium) and paracetamol/codeine combinations have also been used for postoperative analgesia with varying degrees of success<sup>47-49</sup>. Other methods which have been tried to reduce the amount of postoperative pain produced by Filshie clips include the following: local anaesthetics applied to these clips, injected into the mesosalpinx, administered via the cervix or sprinkled around the peritoneum<sup>50-52</sup>. The infiltration of the entry port with 0.5% bupivacaine with adrenaline and the intraperitoneal administration of 10-20 mls of 0.5% bupivacaine with or without adrenaline, following laparoscopic sterilization and pelvic surgery were recommended by Millar<sup>53</sup>. All of

These local anaesthetic methods require the assistance and the cooperation of the operating surgeons. Ketamine, widely used in developing countries for its analgesic and anaesthetics properties was found to produce preemptive analgesia in women undergoing laparoscopic gynaecological surgery when given at a dose of 0.15 mg/kg before skin incision. No demonstrable haemodynamic or psychotomimetic side effects were found at this dosage<sup>54</sup>. Multimodal analgesic regimens that use non-opioid analgesics (e.g. local anaesthetics, non-steroidal anti-inflammatory drugs, cyclo-oxygenase inhibitors, acetaminophen, ketamine and alpha 2-agonists) to supplement opioids analgesics have been successfully used for postoperative pain management. The opioids sparing effects of these compounds have led to a reduced incidence of nausea, vomiting, constipation, urinary retention, respiratory depression and sedation associated with the use of opioids<sup>55</sup>.

### SELECTIVE SPINAL ANESTHESIA

Selective spinal anaesthesia (SSA) is defined as 'the practice of employing minimal doses of intrathecal agents so that only the nerve roots supplying a specific area and only the modalities that require to be anaesthetized are affected'<sup>56</sup>. Dorsal column and motor functions are essentially preserved with SSA, such that patients are able to ambulate at the end of surgery<sup>57</sup>. Various studies on selective spinal anaesthesia for daycase laparoscopy using mini dose hypobaric lidocaine-fentanyl or sufentanil techniques were found to have a higher patient acceptance, no hypotension and faster recovery when compared with the conventional dose hyperbaric lidocaine and general anaesthesia<sup>58,59</sup>.

### DISCHARGE

Daycase patients should meet all the criteria for discharge and home readiness before discharge. Among the criteria are orientation in time, place and person and stable vital signs for over 60 minutes. Other criteria are ability to ambulate unassisted, ability to tolerate oral fluids, ability to void and absence of significant pain and bleeding. Nurse-led discharge according to set criteria can be used. Home readiness does not imply that the patient has the ability to take important decisions, to drive or to return to work. These street fitness activities require complete psychomotor recovery, which is often not achieved until 24-74 hours postoperatively. Phoning in by the patient and follow up phone calls must be encouraged because of the possibility of severe pain or post discharge nausea and vomiting (PDNV). The take home drugs should be prescribed by the anaesthetist and this should include an antiemetic and an analgesic to ensure patient comfort at home and to prevent unanticipated admission.

### CONCLUSION

Daycase laparoscopic procedures are increasingly becoming commonplace and is safe for well-selected Nigerian Journal of Clinical Practice Sept. 2009, Vol.12(3)

patients. Newer drugs with rapid onset and offset, minimal and insignificant risks and short duration of action are now available. The problems associated with carbon dioxide pneumoperitoneum can be prevented by a balanced general anaesthetic technique with efficient ventilation of the lungs. While convenience, habit of the anaesthetist and drug availability may still determine the choice of agents, the morbidity in the form of pain, nausea and vomiting, dizziness and delayed mobilization can be prevented.

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### REFERENCE

1. **Spaner SJ, Warnock GL.** A brief history of endoscopy, laparoscopy, and laparoscopic surgery. *J Laparoendosc Adv Surg Tech A.* 1997; 7: 369-373.
2. **Vecchio R, MacFayden BV, Palazzo F.** History of laparoscopic surgery. *Panminerva Med* 2000; 42: 87-90.
3. **Hatzinger M, Kwon ST, Langbein S, Kamp S, Hacker A, Alken P. Hans Christian Jacobaeus:** Inventor of human laparoscopy and thoracoscopy. *J Endourol* 2006; 20: 848-850.
4. **Moll FH, Marx FJ.** A pioneer in laparoscopy and pelviscopy: Kurt Semm (1927 -2003). *J Endourol* 2005; 19: 269-271.
5. Nigeria better than many European nations in Health care Vamed Boss. [Http.www.independentngonline.com/?c=142&a=26760-27k](http://www.independentngonline.com/?c=142&a=26760-27k).
6. **Safron D, Sgambati S, Orlando R III:** Laparoscopy in high risk cardiac patients. *Surg, Gyne Obst* 1993; 176: 548.
7. **Chung F, Mezei G, Tong D.** Pre-existing medical conditions as predictors of adverse events in daycase surgery. *Br J Anaesth* 1999; 83: 262-270.
8. **Smith I, Cooke T, Jackson I, Fitzpatrick R.** Rising to the challenges of achieving day surgery targets. *Anaesthesia* 2006; 61: 1191-1199.
9. **Hardacre JM, Talamini MA.** Pulmonary and hemodynamic changes during laparoscopy- are they important? *Surgery* 2000; 127: 241-244.

10. **Murdock CM, Wolff AJ, Van Geem T.** Risk factors for hypercarbia, subcutaneous emphysema, pneumothorax and pneumomediastinum during laparoscopy. *Obstet Gynecol* 2000; 95: 705-709.
11. **Maharaj CH, Kallam SR, Malik A, Hassett P, Grady D, Laffey JG.** Preoperative intravenous fluid therapy decreases postoperative nausea and pain in high risk patients. *Anesth Analg* 2005; 100: 675-682.
12. Association of Anaesthetists of Great Britain and Ireland. Recommendations for standards of monitoring during anaesthesia and recovery 4<sup>th</sup> edition. March 2007.
13. **Swann DG, Spens H, Edwards SA, Chestnut RJ.** Anaesthesia for gynaecological laparoscopy a comparison between the laryngeal mask airway and tracheal intubation. *Anaesthesia* 1993; 48: 431-434.
14. **Lobato EB, Paige GB, Brown MM, Bennett B, Davis JD.** Pneumoperitoneum as a risk factor for endobronchial intubation during laparoscopic gynecologic surgery. *Anesth Analg* 1998; 86: 301-303.
15. **Verghese C, Brimacombe JR.** Survey of laryngeal mask airway usage in 11,910 patients: safety and efficacy for conventional and nonconventional usage. *Anesth Analg* 1996; 82: 129-133.
16. **Roberts CJ, Goodman NW.** Gastro-oesophageal reflux during selective laparoscopy. *Anaesthesia* 1990; 45: 1009-1011.
17. **Galvin EM, Van Doorn M, Blazquez J, Ubben JF, Zijlstra FJ, Klein J, et al.** A randomized prospective study comparing the cobra perilaryngeal airway and laryngeal mask airway classic during controlled ventilation for gynaecological laparoscopy. *Anesth Analg* 2007; 104: 102-195.
18. **Hartmann T, Krenn CG, Zoeggeler A, Hoerauf K, Benumof JL, Krafft P.** The oesophageal- tracheal combitube small adult- an alternative for ventilatory support during gynaecological laparoscopy. *Anaesthesia* 2000; 55: 670-675.
19. **Kushimo O.T, Merah N, ffoulkes-Crabbe DJO.** Comparison of propofol with thiopentone in induction of anaesthesia for gynaecological day surgery. *Afr J Anaesth Intens Care* 1997; 3(1): 20-26.
20. **Gupta A, Stierer T, Zuckerman R, Sakima N, Parker SD, Fleisher LA.** Comparison of recovery profile after ambulatory anaesthesia with propofol, isoflurane, sevoflurane and desflurane: a systematic review. *Anesth Analg* 2004; 98: 632-641.
21. **Gan TJ, El-Molem H, Ray J, Glass PS.** Patient-controlled antiemesis: a randomized, double-blind comparison of two doses of propofol versus placebo. *Anesthesiology* 1999; 90: 1564-1570.
22. **Song D, White PF.** Remifentanyl as an adjuvant during desflurane anaesthesia facilitates early recovery after ambulatory surgery. *J Clin Anesth* 1999; 11: 364-367.
23. **Nelskyla K, Korttila K, Yli-Hankala A.** Comparison of sevoflurane-nitrous oxide and propofol-alfentanil-nitrous oxide anaesthesia for minor gynaecological surgery. *Br J Anaesth* 1999; 83: 576-9.
24. **Tang J, Joshi GP, White PF.** Comparison of rocuronium and mivacurium to succinylcholine during outpatient laparoscopic surgery. *Anesth Analg* 1996; 82: 994-998.
25. **Cade L, Kakulase P.** Mivacurium in Daycase surgical patients. *Anaesth Intensive Care* 1997; 25: 133-137.
26. **White PF.** Rapacurium: why did it fail as a replacement for succinylcholine? *Br J Anaesth* 2002; 88: 163-165.
27. **Macario A, Weinger M, Carney S, Kim A.** Which clinical anesthesia outcomes are important to avoid? The perspective of patients. *Anesth Analg* 1999; 89: 652-658.
28. **Simpson RB, Russell D.** Anaesthesia for daycase gynaecological laparoscopy: a survey of clinical practice in the United Kingdom. *Anaesthesia*, 1999; 54: 72-76.
29. **Fuji Y, Tanaka H, Kawasaki T.** Randomized clinical trials of granisetron, droperidol and metoclopramide for the treatment of nausea and vomiting after laparoscopic cholecystectomy. *Br J Surg* 2000; 87: 285-288.
30. **White PF, Tang J, Hamza MA, Ogunaike B, Lo M, Wender RH, et al.** The use of oral granisetron versus intravenous ondansetron for antiemetic prophylaxis in patients undergoing laparoscopic surgery: The effect on emetic symptoms and quality of recovery. *Anesth Analg* 2006; 102: 1387-1393.



31. **Bauer KP, Dom PM, Ramirez AM, O'Flaherty JE.** Preoperative intravenous midazolam: benefits beyond anxiolysis. *J Clin Anesth* 2004; 16: 177-183.
32. **Lee Y, Wang JJ, Yang YL, Chen A, Lai HY.** Midazolam vs ondansetron for preventing postoperative nausea and vomiting: a randomized controlled trial. *Anaesthesia* 2007; 62: 18-22.
33. **Johns RA, Hanousek J, Montgomery JE.** A comparison of cyclizine and granisetron alone and in combination for the prevention of postoperative nausea and vomiting. *Anaesthesia* 2006; 61: 1053-1057.
34. **Kushimo OT, ffoulkes-Crabbe DJO, Nnatu SNN.** Intravenous ranitidine in the prevention of acid aspiration at caesarean section. *Afr J Anaesth Intens Care* 1997; 3(2): 44-46.
35. **Habib AS, Gan TJ.** Combination therapy for postoperative nausea and vomiting- a more effective prophylaxis? *Ambu Surg* 2001; 9: 59-71
36. **White PF.** Prevention of postoperative nausea and vomiting- a multimodal solution to a persistent problem. *N Engl J Med* 2004; 350: 2511-2512.
37. **Habib AS, Gan TJ.** Food and drug administration black box warning on the perioperative use of droperidol: a review of the cases. *Anesth Analg* 2003; 96: 1377-1379.
38. **White PF, Tang J, Song D, Coleman JE, Wender RH, Ogunnaike B, et al.** Transdermal scopolamine: an alternative to ondansetron and droperidol for the prevention of postoperative and postdischarge emetic symptoms. *Anesth Analg* 2007; 104: 92-96.
39. **Diemunsch PA, Van Dorsselaer T, Torp KD, Schaeffer R, Geny B.** Calibrated pneumoperitoneal venting to prevent N<sub>2</sub>O accumulation in the CO<sub>2</sub> pneumoperitoneum during laparoscopy with inhaled anesthesia: an experimental study in pigs. *Anesth Analg* 2002; 94: 1014-1018.
40. **Rudston-Brown B, Draper PN, Warriner B, Walley KR, Phang PT.** Venous gas embolism a comparison of carbon dioxide and helium in pigs. *Can J Anaesth* 1999; 44: 1102-1107.
41. **Koivusalo AM, Kellokumpu I, Scheinin M, Tikkanen I, Makisalo H, Lindgren L.** A comparison of gasless, mechanical and conventional carbon dioxide pneumoperitoneum methods for laparoscopic cholecystectomy. *Anesth Analg* 1998; 86: 153-158.
42. **Pelosi MA.** Self-retaining abdominal retractor for minilaparotomy. *Obstet Gynecol.* 2000; 96:775-778.
43. **Guard BC, Wiltshire SJ.** The effect of glycopyrrolate on postoperative pain and analgesic requirement following laparoscopic sterilization. *Anaesthesia* 1996; 51: 1173-1175.
44. **Habib A, Sharpe A, Anderson S, Francis S, Davidson AC, Smith G.** Buscopan for the treatment of pain after laparoscopic sterilization. *Anaesthesia* 2001; 56: 174-176.
45. **Ali-melkkila TM, Kaila T, Kanto J, E Iisalo.** Pharmacokinetics of IM glycopyrronium. *Br J Anaesth* 1990; 64: 667-669.
46. **Dobb FF, Kumar V, Alexander JJ, Hull MGR.** Pain after laparoscopy related to posture, and ring versus clip sterilization. *Br J Obstet Gynecol* 1987; 94: 262-266.
47. **Chui PT, Gin T.** A comparison between ketorolac and diclofenac in laparoscopic sterilisation. *European Journal of Anaesthesia* 1995; 12: 597-601.
48. **Grace D, Milligan KR, Loughran PG, McCaughey W.** Diclofenac sodium versus fentanyl for analgesia in laparoscopic sterilisation. *Acta Anaesthesiol Scand* 1994; 38: 342-345.
49. **Putland AJ, McCluskey A.** The analgesic efficacy of tramadol versus ketorolac in daycase laparoscopic sterilisation. *Anaesthesia* 1999; 54: 382-385.
50. **Ezeh UO, Shoulder VS, Martin JL, Breeson AJ, Lamb MD, Vellacott ID.** Local anaesthetic on Filshie clips for pain relief after tubal sterilisation: a randomised double-blind trial. *Lancet* 1995; 346: 82-85.
51. **Kelly MC.** An assessment of the value of intraperitoneal bupivacaine for analgesia after laparoscopic sterilisation. *Br J Obstet Gynaecol* 1996; 103: 837-839.

52. **Wheatley SA, Millar JM, Jadaol AR.** Reduction of pain after laparoscopic sterilisation with local bupivacaine: a randomized, parallel, double-blind trial: *Br J Obstet Gynaecol* 1994; 101: 443-446.
53. **Millar JM.** Laparoscopy. In: Millar JM, Rudkin GE, Hitchcock M, eds. *Practical Anaesthesia and Analgesia for Day Surgery*. 2<sup>nd</sup> edition. Oxford; BIOS Scientific Publishers Limited, 1997.
54. **Kwok RFK, Lim J, Chan MTV, Gin T, Chui WKY.** Preoperative ketamine improves postoperative analgesia after gynaecologic laparoscopic surgery. *Anesth Analg* 2004; 98: 1044-1049.
55. **White PF.** The changing role of non-opioid analgesics techniques in the management of post-operative pain. *Anesth Analg* 2005; 101: S5-S22.
56. **Stewart AVG, Vaghadia H, Collins L, Mitchell GWE.** Small-dose selective spinal anaesthesia for short-duration outpatient gynaecological laparoscopy: recovery characteristics compared with propofol anaesthesia. *Br J Anaesth* 2001; 86: 570-572.
57. **Vaghadia H, Solylo M, Henderson C, Mitchell GWE.** Small-dose selective spinal anaesthesia for short duration outpatient gynecological laparoscopy. Epinephrine and spinal cord function. *Can J Anesth* 2001; 48: 261266.
58. **Vaghadia H, Viskar D, Mitchell GWE, Berrill A.** Selective spinal anaesthesia for outpatient laparoscopy. Characteristics of three hypobaric solutions. *Can J Anesth* 2001; 48: 256-260.
59. **Lennox PH, Vaghadia H, Henderson C, Martin L, Mitchell GWE.** Small dose selective spinal anaesthesia for short duration outpatient laparoscopy: Recovery characteristics compared with desflurane anaesthesia. *Anesth Analg* 2002; 94: 346-350.