Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Journal of Gynecology Obstetrics and Human Reproduction 49 (2020) 101813

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en

Original Article

Laparoscopic surgery for benign adnexal conditions under spinal anaesthesia: Towards a multidisciplinary minimally invasive approach

Diego Raimondo[a], Giulia Borghese[a,*], Manuela Mastronardi[a], Mohamed Mabrouk[a,b,c], Paolo Salucci[a], Agnese Lambertini[d], Paolo Casadio[a], Claudia Tonini[d], Maria Cristina Meriggiola[a], Alessandro Arena[a], Giulia Tarozzi[e], Renato Seracchioli[a]

[a] *Gynaecology and Human Reproduction Physiopathology, Dipartimento di Scienze Mediche e Chirurgiche (DIMEC), S. Orsola Hospital, University of Bologna, Via Massarenti 13, 40138 Bologna, Italy*
[b] *Department of Obstetrics and Gynaecology, Faculty of Medicine, University of Alexandria, Champollion street, Al Mesallah Sharq, Qesm Al Attarin, Alexandria Governorate, Egypt*
[c] *Department of Obstetrics and Gynaecology, Faculty of Medicine, University of Cambridge Clinical School, Box 223, The Rosie Hospital, Robinson Way, Cambridge CB2 0SW, United Kingdom*
[d] *Anaesthesiology and Resuscitation Unit, Dipartimento di Scienze Mediche e Chirurgiche (DIMEC) S. Orsola Hospital, University of Bologna, Via Massarenti 13, 40138 Bologna, Italy*
[e] *Anaesthesiology and Pain Medicine Unit, Dipartimento dell'Emergenza-Urgenza, S. Orsola Hospital, University of Bologna, Via Albertoni 15, 40138 Bologna, Italy*

ARTICLE INFO

Article history:
Received 22 October 2019
Received in revised form 10 May 2020
Accepted 11 May 2020
Available online 16 May 2020

Keywords:
General anaesthesia
Laparoscopy
Postoperative pain
Postoperative recovery
Spinal anaesthesia

ABSTRACT

Background: Laparoscopic gynaecological surgery is commonly performed under general anaesthesia with endotracheal intubation. In general surgery, locoregional anaesthesia was applied to laparoscopic procedures, increasing minimally invasive surgery advantages.
Aims: To assess and compare postoperative pain after laparoscopic adnexal procedures for benign conditions under spinal anaesthesia (SA) versus general anaesthesia (GA). Furthermore, anaesthesiologic, surgical and clinical data were evaluated in both groups.
Materials and Methods: This is a prospective cohort study performed in a tertiary level referral centre for minimally invasive gynaecological surgery (Gynaecology and Human Reproduction Physiopathology, University of Bologna). Women scheduled for adnexal laparoscopic surgery for benign conditions between February and May 2019 were assigned to receive either SA or GA with endotracheal intubation. A sample size of 13 women per group was needed to detect a 2-point difference in pain scores.
Main findings: 13 women were enrolled in the SA arm, 15 in the GA arm. In the SA cohort, the most common intraoperative adverse event was shoulder pain, reported by 3/12 women. At 1, 8, 12, 24 and 48 h after surgery pain was significantly lower in the SA arm ($p < .05$). Patients submitted to SA experienced no need for opioid drugs administration, unlike those receiving GA. Patients' mobilization and return of bowel function were noted significantly earlier in the SA group ($p < .05$).
Conclusions: SA is a feasible, safe and effective anaesthesiologic technique for laparoscopic gynaecological procedures for benign conditions, allowing a better control of postoperative pain. Women undergoing SA achieve earlier mobilization and bowel canalization. During the Covid-19 pandemics, SA could be useful in reducing the need for invasive procedures on respiratory tract.

Abbreviations: ASA, American Society of Anesthesiologist; BMI, body mass index; ETCO2, end-tidal CO2; GA, general anaesthesia; LRA, locoregional anaesthesia; NSAID, non-steroid anti-inflammatory drugs; PONV, postoperative nausea and vomiting; SA, spinal anaesthesia; VNRS, verbal numerical rating scale.

* Corresponding author.
E-mail addresses: Die.raimondo@gmail.com (D. Raimondo), Giuliamaria.borghese@gmail.com (G. Borghese), Manuela.mastronardi@gmail.com (M. Mastronardi), Mohamed.mabrouk@aosp.bo.it (M. Mabrouk), saluccip@gmail.com (P. Salucci), Agnese.lambertini@aosp.bo.it (A. Lambertini), Paolo.casadio@aosp.bo.it (P. Casadio), Claudia.tonini@aosp.bo.it (C. Tonini), Cristina.meriggiola@unibo.it (M.C. Meriggiola), Alessandroarena1588@aosp.bo.it (A. Arena), Giulia.tarozzi@aosp.bo.it (G. Tarozzi), renato.seracchioli@unibo.it (R. Seracchioli).

http://dx.doi.org/10.1016/j.jogoh.2020.101813
2468-7847/

Introduction

Over the years, minimally invasive approach and additional locoregional anaesthesia (LRA) assumed the role of major tools to decrease postoperative pain and to enhance postoperative recovery [1,2].

The laparoscopic approach has several advantages over open surgery, including less postoperative pain and morbidity, more rapid recovery, shorter hospital stay and reduced overall costs [3–5].

Laparoscopic procedures are commonly performed under general anaesthesia (GA) with endotracheal intubation to prevent aspiration, respiratory distress, discomfort and shoulder pain due to induction of pneumoperitoneum. The use of LRA during laparoscopy is usually combined with GA in order to decrease postoperative pain. Under certain circumstances, such as in patients with severe comorbidities limiting GA [6], it is used as the sole anaesthesiologic method (spinal anaesthesia (SA), epidural anaesthesia or combined techniques).

Recently, according to general surgeons' experience, the combination of minimally invasive surgery and LRA appeared to increase laparoscopic procedures advantages [7–9]. In general surgery SA has been largely applied to laparoscopic procedures, especially cholecystectomy [10]. Different Authors reported better muscle relaxation, reduced metabolic responses to surgical stress, more rapid postoperative bowel canalization, less postoperative pain and lower incidence of postoperative nausea and vomiting (PONV) in patients submitted to SA compared to GA.

Evidences about the outcomes of exclusive LRA in gynaecologic literature are scarce.

The primary objective of this study was to assess and compare postoperative pain after laparoscopic adnexal procedures for benign conditions under SA versus GA. Furthermore, anaesthesiologic, surgical and clinical data were evaluated between the two groups. In particular we recorded as secondary outcomes: need for intravenous opioid drugs administration, incidence of PONV, time of patient's autonomous mobilization, feeding and bowel canalization.

Materials and methods

This is a prospective cohort study performed in a tertiary level referral centre for minimally invasive gynaecological surgery. Continuous women matching study criteria and referring to our centre between February 2019 and May 2019 were enrolled.

Inclusion criteria were: women scheduled for adnexal laparoscopic surgery for benign gynaecological conditions, aged more than 18 years old, written informed consent to participate to the study. Exclusion criteria were contraindications to GA o LRA and suspected malignancy. Contraindications to SA include patient's refusal, infection at the site of injection, coagulopathy (acquired, induced, genetic), allergy to local anaesthetics, sepsis, uncooperative patient (dementia, psychosis, emotional instability), increased intra-cranial pressure [11]. We consider GA contraindicated for ASA III / IV severely compromised patients.

During preoperative work-up, all patients underwent gynaecological examination and a detailed pelvic ultrasound scan was performed by expert sonographers [12]. Women scheduled for exclusive adnexal surgery were invited to participate in the study during the preoperative anaesthesiologic examination. After a detailed counselling about anaesthesia in laparoscopic surgery, and clinical and practical implications of both GA and SA, an informed written consent was obtained. Patients' allocation in the two arms of the study (SA or GA with endotracheal intubation) was performed according to their preference.

The following clinical data were recorded:

- Preoperative variables: demographic and anamnestic data.
- Intraoperative surgical variables: type of surgical procedure, anaesthesiologic technique, operative time (from skin incision to suture), pneumoperitoneum duration (from pneumoperitoneum induction to desufflation), intrabdominal maximum pressure, pneumoperitoneum maintenance pressure and laparotomic conversion rate.
- Intraoperative anaesthesiologic variables: drugs and drug-doses for GA, SA and sedation, intra-operative vital signs (blood pressure, minimum respiratory rate, heart rate, end-tidal CO2 [ETCO2], minimum blood oxygen saturation), intraoperative adverse events (pain and need of opioids in women undergoing LRA, respiratory abnormalities, cardiovascular abnormalities), conversion rate from SA to GA.
- Postoperative variables during hospital stay and after discharge (assessed through telephonic interview): pain at 1, 8, 12, 24 and 48 postoperative hours assessed by the 11-point verbal numerical rating scale (VNRS), postoperative need of opioids (in addition to basal analgesic therapy with non-steroid anti-inflammatory drugs [NSAID] and / or paracetamol), postoperative adverse events (PONV, shoulder pain, urinary retention), time of first mobilization and bowel canalization to gas, duration of hospital stay. VNRS is a validate rating scale commonly used to assess pain and the effect of pain therapies. Patients are invited to rate their pain on a verbal numeric scale from no pain to the worst pain imaginable [13].

In our hospital, criteria for hospital discharge included: women tolerating oral feeding, with bowel canalization to gas and spontaneous micturition.

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics 25.0 software (IBM Corp., Armonk, NY, USA). Continuous variables were presented as mean and standard deviations or medians and ranges and were compared using the Mann-Whitney test and the T-test for non-normally distributed and normally distributed data, respectively. Categorical data were expressed as percentage ad absolute rates were compared using Fisher's exact and Chi-square test, as appropriate. A sample size of 13 women per group was needed to detect a two-point difference in pain scores with a power of 80 % and a type 1 error (alpha) of .05, assuming the standard deviation of the differences to be two. A 2-point difference in pain scores was chosen according to the literature as the minimum clinically meaningful difference [14]. The analysis was carried out on a "per protocol" basis.

Ethical approval

The study was approved by local research ethics committee (protocol number: 160/2016/O/Oss) and was registered on Clinicaltrial.gov international register (identification code: NCT03830086).

Results

30 consecutive patients were asked to participate to the study, of whom 28 agreed and two refused (Fig. 1). 28 women were therefore enrolled in the study according to the inclusion criteria. 13 women were included in the SA arm, while the remaining 15 in the GA arm. One case required the conversion from SA to GA because of patient's anxiety and agitation. No patients required laparotomic conversion.

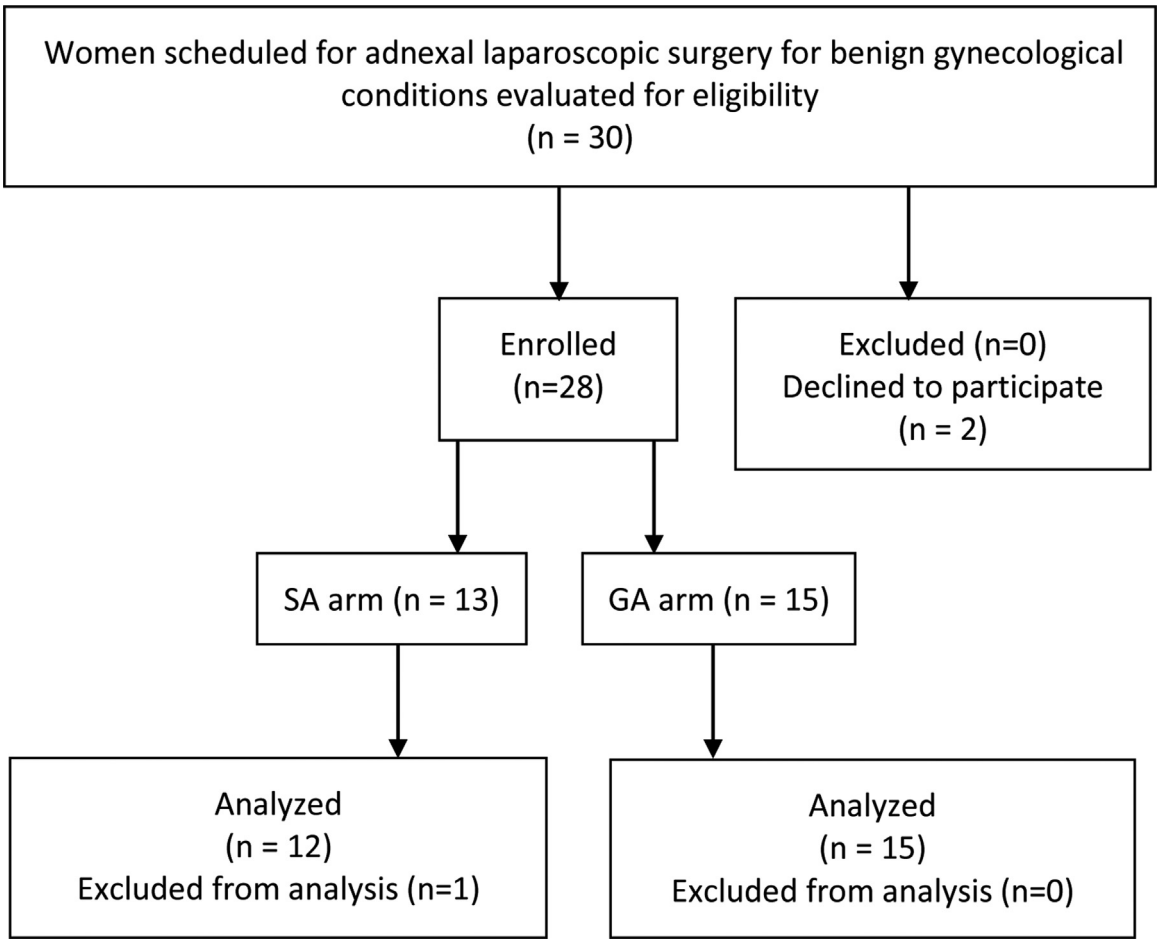

Fig. 1. Study Flow diagram.

Demographic and preoperative data

Demographic and preoperative features are shown in Table 1. There were no significant differences between the two groups with regard to age, BMI, ASA status, smoking preference and comorbidities (defined as any condition requiring chronic therapy, detailed in Table 1). No patients reported a preoperative history of chronic pain.

Intraoperative findings

Intraoperative data are presented in Table 2. 16 women underwent ovarian cystectomy for endometriotic or dermoid cysts (nine in the GA group, seven in the SA group), while 12 women underwent mono- or bilateral adnexectomy (six women in both the GA and the SA group). The mean operative time and pneumoperitoneum duration were similar for both groups.

No significant differences in mean minimum respiratory rate, minimum blood oxygen saturation, pre- and post-pneumoperitoneum ETCO2 between the two arms were observed. Mean intra-abdominal pressure at pneumoperitoneum induction and mean pneumoperitoneum maintenance pressure were similar in the two groups (14.5 ± 2.7 mmHg at pneumoperitoneum induction and 9.7 ± 2.1 mmHg for pneumoperitoneum maintenance). Concerning the SA cohort, the most common intraoperative adverse event was shoulder pain, reported by three out of 12 (25.0 %) women; of these, only in one case (8.3 %) opioid administration was required (3 g i.v. Sufentanil). Among women submitted to SA, one out of 12 (8.3 %) experienced bradycardia, resolved without therapy. In one patient (8.3 %) hypotension at the beginning of abdominal CO2 insufflation was treated with intravenous plasma expander 500 ml. No other adverse events were intraoperatively recorded in the SA arm. In particular, no women experienced respiratory fatigue or depression. No relevant adverse events were reported in the GA cohort.

Table 1
Demographic characteristics of women undergoing general (GA) or spinal (SA) anaesthesia.

	GA	% GA	SA	% SA	p-value
N of women	15 (55.6 %)		13 (44.4 %)		
Age (years old) mean ± SD	34.5 ± 7.7		49.0 ± 23.1		.256
BMI (kg/m2), mean ± SD	22.1 ± 2.4		22.9 ± 4.1		.856
Comorbidities, n	6/15	40.0	7/13	53.8	1.000
Arterial Hypertension	3	20.0	4	30.8	
Diabetes	1	6.6	2	15.4	
Hypothyroidism	3	20.0	3	23.1	
History of chronic pain	0/15	0.0	0/13	0.0	
History of PONV, n	0/15	0.0	0/13	0.0	
Smoke habit, n	6/15	40.0	3/13	23.1	.435
ASA class					.751
1	7/15	46.7	7/13	53.8	
2	8/15	53.3	6/13	46.2	

Legend: ASA: American Society of Anesthesiologist, BMI: Body Mass Index, GA: general anaesthesia, N: number, PONV: postoperative nausea and vomiting, SA: spinal anaesthesia,SD: standard deviation.

Postoperative findings

Postoperative data are reported in Table 3. At each detection during postoperative recovery (1, 8, 12, 24 and 48 h after surgery),

Table 2
Intraoperative data.

	GA	SA	p-value
Surgical procedure			
Ovarian cystectomy	9 (60 %)	7 (53.8 %)	
Adnexectomy	6 (40 %)	6 (46.2 %)	
Minimum respiratory frequency, mean ± SD	11.4 ± 0.8	11.8 ± 2	.614
ETCO2 before pneumoperitoneum (mmHg), mean ± SD	28 ± 0	28.2 ± 5.5	.838
ETCO2 after pneumoperitoneum (mmHg), mean ± SD	32.9 ± 2.6	33.3 ± 5.9	.813
Minimum SpO2, mean ± SD	98 ± 0.9	96.1 ± 3	.109
Total fluids (ml), mean ± SD	1113.3 ± 398	880 ± 232.2	.134
Pneumoperitoneum duration (min), mean ± SD	36.3 ± 6.8	40.4 ± 7.2	.200
Operative time (min), mean ± SD	48.7 ± 6.04	54.2 ± 8.5	.093

Legend: ETCO2: end-tidal CO2, GA: general anaesthesia, ml: millilitres, N: number, SA: spinal anaesthesia, SD: standard deviation.

Table 3
Postoperative data.

	GA	% GA	SA	% SA	p-value
Postoperative pain (VNRS); median (range)					
1 h	7 (4–10)		1 (0–7)		< **.001**
8 h	8 (3–10)		3 (0–5)		< **.001**
12 h	7 (0–9)		2 (0–4)		< **.001**
24 h	5 (0–7)		1 (0–4)		< **.001**
48 h	3 (0–5)		0 (0–1)		**.005**
Time of mobilization (hours), mean ± SD	6.9 ± 1.4		3.3 ± 1.1		**.001**
Time of bowel canalization to gas (hours), mean ± SD	11.3 ± 1.9		8.0 ± 2.0		**.001**
Length of hospital stay in hours, mean ± SD	19.4 ± 5.9		20.8 ± 7.4		.580
Postoperative Adverse Events					
Urinary retention, n	0	0.0	0/12	0.0	
PONV, n	3/15	20.0	1/12	8.3	.400
Use of opioids, n	8/15	53.3	0/11	0.0	**.007**

Legend: GA: general anaesthesia, N: number, PONV: postoperative nausea and vomiting, SA: spinal anaesthesia, SD: standard deviation, VNRS: verbal numerical rating scale.

pain assessed through VNRS was significantly lower in SA arm than in GA arm. Nausea and vomiting were reported in three out of 15 (20 %) women that received GA, and in one patient (8.3 %) submitted to SA (p = .400). 8 out of 15 (53.3 %) women in the GA group and nobody in the SA group required opioid drugs intravenous administration (p = .007).

Return of bowel function occurred significantly earlier in the SA group than in the GA group (8.0 ± 2.0 versus 11.3 ± 1.9 postoperative hours), as well as autonomous deambulation (3.3 ± 1.1 versus 6.9 ± 1.4 postoperative hours). Urinary bladder catheter was removed after patients' autonomous mobilization. No women experienced postoperative urinary retention.

Discussion

LRA during laparoscopic adnexal surgery for benign gynaecological conditions provides several advantages: less postoperative pain with reduced need of postoperative opiod drugs administration, earlier bowel canalization to gas and autonomous mobilization.

Women in SA group reported significantly lower pain scores at all the postoperative detections compared to GA arm. In particular, the major difference was observed one hour after surgery, when a statistically significant 6-points difference in VAS score was found. This finding could be partially due to the recent spinal drug infusion in the SA group; conversely, GA patients regained consciousness and were therefore experiencing first postoperative pain. However, SA benefits on postoperative pain compared to GA group remained statistically significant at subsequent detections at 8, 12, 24 and 48 postoperative hours, with no women in SA arm requiring additional intravenous opioids administration. Moreover, they achieved earlier return of bowel function and autonomous deambulation. These factors may contribute to the better control of postoperative pain by avoiding paralytic ileus and muscular pain and fatigue due to a longer bed stay.

A good and persistent postoperative pain control is pivotal in order to enhance recovery [15,16]. LRA and minimally invasive approach are major tools allowing a better control of postoperative pain and achieving earlier mobilization, feeding and bowel canalization [17,18]. During the ongoing Covid-19 pandemics, LRA could represent an effective tool to reduce invasive procedures on respiratory tract, limiting contamination risk. Furthermore, patients' enhanced recovery possibly decreases the need for intensive care admission.

A large metanalysis of 141 studies evaluating epidural or spinal anaesthesia on postoperative morbidity and mortality in general surgery, urology, vascular surgery, orthopaedics and other surgeries showed improved survival in patients randomized to neuraxial blockade, whether or not combined with concomitant GA [19].

Recently, in general surgery, growing literature evidence supports the use of exclusive LRA in patients undergoing laparoscopy, especially cholecystectomy [10]. In 2009 Sinha et al. [9] reported over 3400 patients submitted to laparoscopic cholecystectomy under spinal anaesthesia, and described an excellent muscle relaxation, less bleeding during surgery and a more rapid postoperative bowel canalization compared to patients undergoing GA. Tzovaras et al. [8] reported significantly less postoperative pain for the LRA group compared to GA patients. Bessa et al. [20] described lower incidence of PONV and shorter hospital stay in the LRA group of patients.

A recent randomized controlled clinical trial [21] did not find any hemodynamic change nor ventilatory depression due to LRA compared to GA and suggested a lower degree of neuroendocrine stress in LRA patients. A systematic review and meta-analysis of 8 trials involving 732 patients submitted to laparoscopic cholecystectomy under LRA or GA showed that postoperative pain and

PONV were significantly lower in the LRA group, while postoperative urine retention rate was higher in the LRA group [22].

Only a few studies specifically reported experiences about exclusive LRA (without concomitant GA) in gynaecologic laparoscopic surgery. Zullo et al. described 32 women submitted to mini-laparoscopic ovarian drilling under LRA plus conscious sedation compared to 30 women undergoing traditional laparoscopic ovarian drilling under GA [23]. The LRA arm showed a significantly better outcome in terms of postoperative analgesic requirements and early hospital discharge. In 2013, Pellegrino et al. presented 13 women successfully submitted to gas-less laparoscopic gynaecological surgery with laparotenser for benign pathology under LRA plus tap block [24]. A small clinical trial demonstrated the feasibility of single-port laparoscopic surgery for adnexal masses under LRA [25]. Azgari et al. reported 84 women submitted to laparoscopic gynaecological surgery, randomized to receive SA plus sub-diaphragmatic lidocaine, SA alone or GA. Pain scores differences in the three groups assessed after surgery and the time of discharge were not statistically significant [26]. A recent series evaluated 80 women submitted to gynaecological laparoscopic surgery under LRA, randomized to receive transcutaneous electrical nerve stimulation or intravenous Fentanyl to decrease intraoperative shoulder pain [27]; no differences in pain relief were found.

Implementing the use of exclusive LRA, GA and tracheal intubation sequelae such as sore throat, muscular pain and eventual airways trauma can be avoided. Nevertheless, LRA requires a collaborating, not anxious patient, without language barrier. Intra-abdominal pressures have to be maintained low, in order to reduce chest discomfort and shoulder pain due to the diaphragmatic irritation caused by pneumoperitoneum [28]. Trendelenburg positioning should be minimized. In cases requiring an increased intravenous sedation, the combined effect of LRA, pneumoperitoneum and intravenous drugs may lead to severe hypotension, hypoventilation and hypoxemia [29]. Moreover, urinary retention could be a LRA serious disadvantage, in some cases requiring urinary catheterization [28].

According to our preliminary data, spinal anaesthesia appears to be a feasible, safe and effective anaesthesiologic technique for laparoscopic gynaecological procedures for benign conditions, allowing a better control of postoperative pain, reduced need of postoperative opiod drugs administration, earlier return of bowel function and autonomous mobilization. During the ongoing Covid-19 pandemics, SA could be useful in reducing the need for invasive procedures on respiratory tract, limiting contamination risk. We included short operating time procedures under locoregional or general anaesthesia and we conducted a prospective cohort study, mimicking clinical decision-making in real-world contexts [30]. Strengths of our study include its prospective design and the sample size calculation. Our results, however, cannot be generalized because of the selective inclusion of women with benign adnexal conditions and the lack of randomization. Further studies should evaluate patients' satisfaction after LRA.

Funding

None.

References

[1] Muzii L, Achilli C, Bergamini V, Candiani M, Garavaglia E, Lazzeri L, et al. Comparison between the stripping technique and the combined excisional/ablative technique for the treatment of bilateral ovarian endometriomas: a multicentre RCT. Hum Reprod Oxf Engl 2016;31:339–44, doi:http://dx.doi.org/10.1093/humrep/dev313.

[2] Seracchioli R, Hourcabie JAA, Vianello F, Govoni F, Pollastri P, Venturoli S. Laparoscopic treatment of pelvic floor defects in women of reproductive age. J Am Assoc Gynecol Laparosc 2004;11:332–5, doi:http://dx.doi.org/10.1016/S1074-3804(05)60045-X.

[3] Singh RK, Saini AM, Goel N, Bisht D, Seth A. Major laparoscopic surgery under regional anesthesia: a prospective feasibility study. Med J Armed Forces India 2015;71:126–31, doi:http://dx.doi.org/10.1016/j.mjafi.2014.12.010.

[4] Bulletti C, Seracchioli R, Polli V, Albonetti A, Rossi S, Barbieri L, et al. Financial impact in the Italian Health Service of laparoscopic versus laparotomic surgery for the treatment of ovarian cysts. Hum Reprod 1996;11:287–90, doi:http://dx.doi.org/10.1093/HUMREP/11.2.287.

[5] Seracchioli R, Venturoli S, Colombo FM, Bagnoli A, Vianello F, Govoni F, et al. GnRH agonist treatment before total laparoscopic hysterectomy for large uteri. J Am Assoc Gynecol Laparosc 2003;10:316–9, doi:http://dx.doi.org/10.1016/S1074-3804(05)60254-X.

[6] Gramatica L, Brasesco OE, Mercado Luna A, Martinessi V, Panebianco G, Labaque F, et al. Laparoscopic cholecystectomy performed under regionalanesthesia in patients with chronic obstructive pulmonary disease. Surg Endosc Interv Tech 2002;16:472–5, doi:http://dx.doi.org/10.1007/s00464-001-8148-0.

[7] Ross SB, Mangar D, Karlnoski R, Camporesi E, Downes K, Luberice K, et al. Laparo-endoscopic single-site (LESS) cholecystectomy with epidural vs. General anesthesia. Surg Endosc 2013;27:1810–9, doi:http://dx.doi.org/10.1007/s00464-012-2667-8.

[8] Tzovaras G, Fafoulakis F, Pratsas K, Georgopoulou S, Stamatiou G, Hatzitheofilou C. Laparoscopic cholecystectomy under spinal anesthesia: a pilot study. Surg Endosc 2006;20:580–2, doi:http://dx.doi.org/10.1007/s00464-005-0405-1.

[9] Sinha R, Gurwara AK, Gupta SC. Laparoscopic cholecystectomy under spinal anesthesia: a study of 3492 patients. J Laparoendosc Adv Surg Tech A 2009;19:323–7, doi:http://dx.doi.org/10.1089/lap.2008.0393.

[10] van Zundert AAJ, Stultiens G, Jakimowicz JJ, Peek D, van der Ham WG, Korsten HH, et al. Laparoscopic cholecystectomy under segmental thoracic spinal anaesthesia: a feasibility study. Br J Anaesth 2007;98:682–6, doi:http://dx.doi.org/10.1093/bja/aem058.

[11] Bertini L, Savoia G, De Nicola A, Ivani G, Gravino E, Albani A, et al. SIAARTI guidelines for safety in locoregional anaesthesia. Minerva Anestesiol 2006;72:689–722.

[12] Savelli L, Manuzzi L, Coe M, Mabrouk M, Di Donato N, Venturoli S, et al. Comparison of transvaginal sonography and double-contrast barium enema for diagnosing deep infiltrating endometriosis of the posterior compartment. Ultrasound Obstet Gynecol 2011;38:466–71, doi:http://dx.doi.org/10.1002/uog.9072.

[13] Holdgate A, Asha S, Craig J, Thompson J. Comparison of a verbal numeric rating scale with the visual analogue scale for the measurement of acute pain. Emerg Med (NY) 2003;15:441–6, doi:http://dx.doi.org/10.1046/j.1442-2026.2003.00499.x.

[14] Portenoy RK, Berlin JA, Kinman JL, Stromb BL. Defining the clinically important difference in pain outcome measures. Pain 2000;88:287–94.

[15] Carli F, Kehlet H, Baldini G, Steel A, McRae K, Slinger P, et al. Evidence basis for regional anesthesia in multidisciplinary fast-track surgical care pathways. Reg Anesth Pain Med 2011;36:63–72, doi:http://dx.doi.org/10.1097/AAP.0b013e31820307f7.

[16] Seracchioli R, Bagnoli A, Colombo FM, Missiroli S, Venturoli S. Conservative treatment of recurrent ovarian fibromas in a young patient affected by Gorlin syndrome. Hum Reprod Oxf Engl 2001;16:1261–3.

[17] Uccella S, Bonzini M, Palomba S, et al. Laparoscopic vs. Open treatment of endometrial cancer in the elderly and very elderly: an age-stratified multicenter study on 1606 women. Gynecol Oncol 2016;141:211–7, doi:http://dx.doi.org/10.1016/j.ygyno.2016.02.029.

[18] Seracchioli R, Venturoli S, Ceccarin M, Cantarelli M, Ceccaroni M, PIgnotti E, et al. Is total laparoscopic surgery for endometrial carcinoma at risk of local recurrence? A long-term survival. Anticancer Res 2005;25:2423–8.

[19] Rodgers A, Walker N, Schug S, McKee A, Kehlet H, van Zundert A, et al. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials. Br Med J 2000;321:1493.

[20] Bessa SS, Katri KM, Abdel-Salam WN, El-Kayal el-SA, Tawfik TA. Spinal versus general anesthesia for day-case laparoscopic cholecystectomy: a prospective randomized study. J Laparoendosc Adv Surg Tech A 2012;22:550–5, doi:http://dx.doi.org/10.1089/lap.2012.0110.

[21] Das W, Bhattacharya S, Ghosh S, Saha S, Mallik S, Pal S. Comparison between general anesthesia and spinal anesthesia in attenuation of stress response in laparoscopic cholecystectomy: a randomized prospective trial. Saudi J Anaesth 2015;9:184–8, doi:http://dx.doi.org/10.4103/1658-354X.152881.

[22] Wang XXX, Zhou Q, Pan DBB, Deng HW, Zhou AG, Guo HJ, et al. Comparison of postoperative events between spinal anesthesia and general anesthesia in laparoscopic cholecystectomy: a systemic review and meta-analysis of randomized controlled trials. Biomed Res Int 2016;2016:9480539, doi:http://dx.doi.org/10.1155/2016/9480539.

[23] Zullo F, Pellicano M, Zupi E, Guida M, Mastrantonio P, Nappi C. Minilaparoscopic ovarian drilling under local anesthesia in patients with polycystic ovary syndrome. Fertil Steril 2000;74:376–9.

[24] Pellegrino A, Damiani GR, Speciale D, Speciale R, Massei R, Landi S, et al. Transversus abdominis plane block associated with locoregional anesthesia with a laparotenser for gynecologic surgery in an awake state. J Minim Invasive Gynecol 2013;20:230–3, doi:http://dx.doi.org/10.1016/j.jmig.2012.11.009.

[25] Kim KH, Kim YH, Yun KY, Han SE, Kim ES, Kwon BS, et al. Laparoscopically assisted suprapubic surgery for adnexal tumors under epidural anesthesia. Minim Invasiv Ther 2017;26:39–43, doi:http://dx.doi.org/10.1080/13645706.2016.1223695.
[26] Asgari Z, Rezaeinejad M, Hosseini R, Nataj M, Razavi M, Sepidarkish M. Spinal anesthesia and spinal anesthesia with subdiaphragmatic lidocaine in shoulder pain reduction for gynecological laparoscopic surgery: a randomized clinical trial. Pain Res Manage 2017;2017:1721460, doi:http://dx.doi.org/10.1155/2017/1721460.
[27] Asgari Z, Tavoli Z, Hosseini R, Nataj M, Tabatabaei F, Dehghanizadeh F, et al. A comparative study between transcutaneous electrical nerve stimulation and fentanyl to relieve shoulder pain during laparoscopic gynecologic surgery under spinal anesthesia: a randomized clinical trail. Pain Res Manage 2018;2018:9715142, doi:http://dx.doi.org/10.1155/2018/9715142.
[28] Vretzakis G, Bareka M, Aretha D, Karanikolas M. Regional anesthesia for laparoscopic surgery: a narrative review. J Anesth 2014;28:429–46, doi:http://dx.doi.org/10.1007/s00540-013-1736-z.
[29] Haydon GH, Dillon J, Simpson KJ, Thomas H, Hayes PC. Hypoxemia during diagnostic laparoscopy: a prospective study. Gastrointest Endosc 1996;44:124–8.
[30] Kowalski CJ, Mrdjenovich AJ. Patient preference clinical trials: why and when they will sometimes be preferred. Perspect Biol Med 2013;56:18–35, doi:http://dx.doi.org/10.1353/pbm.2013.0004.