Oxygenation, Ventilation and Hemodynamic Changes during Diagnostic Pelvic Laparoscopy in Siriraj Hospital

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Abstract : *During laparoscopic procedure, an alteration in hemodynamic and pulmonary mechanic was noted. An appropriate anesthetic technique is still under debate in term of safety and low cost benefit ratio. Thirty five female patients undergoing diagnostic pelvic laparoscopy in Siriraj Hospital for gynaecologic reasons were investigated. Laparoscopy was done under local anaesthetic technique and supplemented with systemic sedation and analgesia. Hemodynamic (MAP, PR, ECG), oxygenation and ventilation (SpO_2, $EtCO_2$, ABG) changes at baseline control, post sedation, post CO_2 insufflation, post CO_2 exsufflation and postoperative periods were compared. Hemodynamic changes were not significant difference. Pulse oxygen saturation (SpO_2) and arterial O_2 tension decreased significantly at post sedation period. Six patients had O_2 saturation less than 95 per cent and three less than 92 per cent. An increase in end tidal CO_2 ($EtCO_2$) was observed at post sedation and postoperative periods. Three patients had $EtCO_2$ more than 50 mmHg. Although diagnostic pelvic laparoscopy is classified as a minor procedure, oxygenation and ventilation changes could be anticipated due to the effect of posture and pneumoperitoneum with CO_2 gas. Local anaesthetic technique with conscious sedation has an advantage over general anaesthesia because of low cost and simplicity of the technique. Nevertheless on the safe side, simple O_2 supplement, hemodynamic and respiratory monitoring are recommended to avoid a decrease in oxygenation and a prompt response to any abnormalities. (Thai J Obstet Gynaecol 1995;7:135-141)*

Short title : Hemodynamic changes during laparoscopy

Key words : pelvic laparoscopy, O_2 saturation, end tidal CO_2

Pelvic laparoscopy has been commonly performed as a diagnostic procedure for gynaecologic reasons. During this procedure, patients should not only be placed in the lithotomy plus Trendelenberg position but also

be insufflated with CO_2 gas into peritoneal cavity to facilitate surgical procedure. Clinical observation found an increase in arterial CO_2 tension either with spontaneous or controlled ventilation[1-3] and in cardiac arrhythmia with halothane anesthesia.[1,4,5] The anaesthetic technique and agents should be considered based on a safe practice and low cost benefit ratio.

In Siriraj Hospital this procedure is routinely done under local anaesthesia with systemic sedation and analgesia.

Although there was no claim on any serious complications under this technique, no academic on hemodynamic and respiratory changes has been reported. So we would like to evaluate an alteration in oxygenation, ventilation and hemodynamic status during this procedure as well as the appraisal of both surgeons and patients towards this technique.

Materials and Methods

Thirty five female patients (American Society of Anesthesiologists' physical status I, II) undergoing elective diagnostic pelvic laparoscopy in Obstetric and Gynaecology department of Siriraj hospital were studied. Written consent were received after preoperative explanation of anaesthetic technique and surgical procedure. Noninvasive blood presure (NIBP), oscilloscopic electrocardiography (ECG), pulse oxygen saturation (SpO_2), end tidal CO_2 ($EtCO_2$) and arterial blood gases (ABG) were monitored at preanaesthetic control, 15 min. postsedation, 5 min. post CO_2 insufflation, 5 min. post CO_2 exsufflation and 30 min. post operative periods. Arterial blood gas samples were drawn from an indwelling 22 G radial artery canula inserted at a nondependent site after negative abnormal Allen's test. Dehydrobenzperidol 2.5-5.0 mg, pethidine 50-100 mg and atropine 0.3 mg were given intravenously for sedation and analgesia. Regarding the safety criteria, if SpO_2 dropped down to 90 per cent or less for more than 1 min, O_2 6 litres per minute (LPM) supplementation via face mask would be given; if $EtCO_2$ rose up to 50 mmHg or more for more than 1 min., assisted ventilation would be performed. All data were statistically analysed.

Results

Table 1 showed patients' characteristics, operative time, intraabdominal pressure and total CO_2 volume. There was no significant change in mean arterial pressure (MAP) compared at different times except a significant decrease at postoperative time. A significant increase in heart rate during postmedication, and procedure was observed due either to an effect of atropine, a response to pain or an increase in $EtCO_2$. Nevertheless no cardiac arrhythmia was noted in this study (Fig. 1). Although there was a statistically significant decrease in SpO_2 at post-

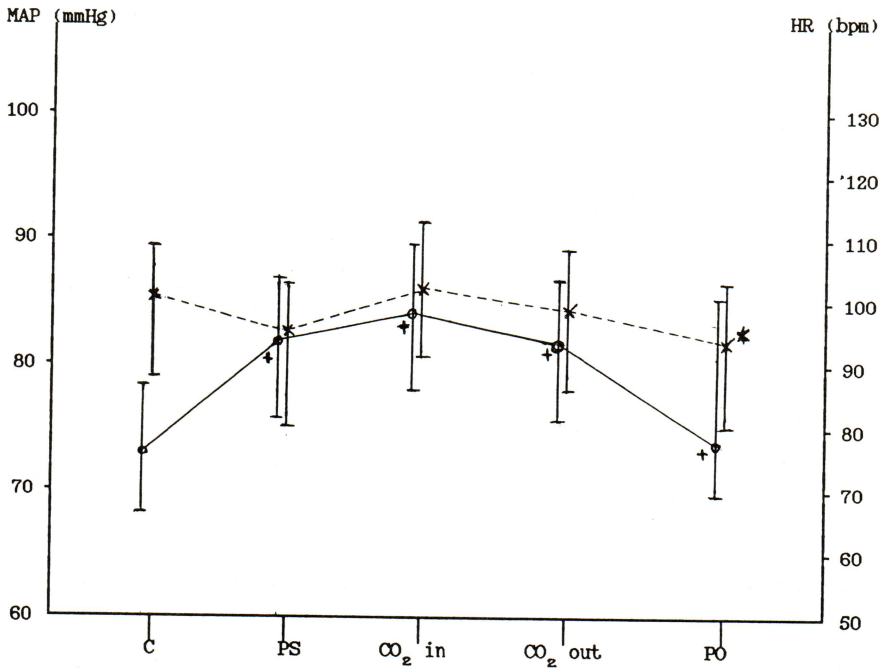

Fig. 1 Hemodynamic parameter (MAP, HR) at baseline control (C), post sedation (PS) post Co_2 insufflation (CO_2 in), post Co_2 exsufflation (CO_2 out) and postoperation period (PO)

X--------X MAP * Sig diff p < 0.05
O_____O HR + Sig diff p < 0.05

Table 1 ***Patients' characteristics, operative time (Op time), intraabdominal pressure (intraabd. pr.) and the total CO_2 volume***

	Age (yr)	Wt (kg)	Ht (cm)	Op time (min)	Intraabd. pr. (mm Hg)	Total CO_2 (L)
Mean ± SD	29.9 ± 5.78	50.27 ± 8.41	155.92 ± 5.14	11± 4.97	17.7 ± 3.55	1.88 ± 0.82
Range	18 - 44	31 - 67	148 - 170	7 - 26	12 - 25	1 - 5

Table 2 ***Pulse O_2 saturation (SpO_2) at baseline control (C), post sedation (PS), post CO_2 insufflation (CO_2 in), post CO_2 exsufflation (CO_2 out), and postoperative periods (PO).***

	C	PS	CO_2 in	CO_2 out	PO
Mean ± SD	98.4 ± 1.16	95.52 ± 2.35*	97.44 ± 1.50*	97.17 ± 1.46*	97.48 ± 1.46*
Range	96 - 100	89 - 99	94 - 100	93 - 99	94 - 100

* sig diff p < 0.05

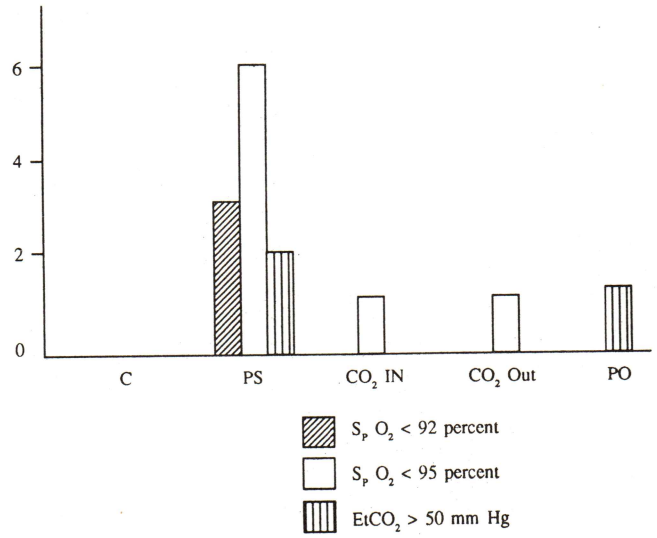

Fig. 2 Number of patients having O_2 saturation less than 95 and 92 percent and end tidal CO_2 more than 50 mm Hg at different period of times.

sedation, during the procedure and postoperative period. The mean SpO_2 were higher than 95 per cent (Table 2). However a decrease in SpO_2 was markedly observed at postsedation, six and three patients had SpO_2 less than 95 and 92 per cent respectively (Fig. 2). An increase in $EtCO_2$ was highest at postsedation possibly due to a lack of surgical stimulation. Two patients had $EtCO_2$ more than 50 mmHg. (Fig. 2). Respiratory rate increased during the procedure (Table 3). The change of arterial blood gases was similar to the change of SpO_2 and $EtCO_2$ (Table 4).

Before the patients were discharged home, they were asked about their satisfaction and comment on this anesthetic technique. Fifty-seven per cent of the patients were satisfied, 15 per cent requested general anesthesia and 28 per cent had no comment. Some of those who have had a previous general anesthesia preferred this technique to general anesthesia, some did not. Most of the patients who had no comment would like to leave the choice of anesthetic technique to their doctors. Nevertheless the most common two complaints of this technique were pain and uncomfortable feeling during the procedure.

Discussion

Nowadays pelvic laparoscopy has been increasing in popularity for diagnostic and therapeutic reasons. The surgical demand of Trendelenberg position and pneumoperitoneum with CO_2 gas create untoward effects to respiratory and cardiovascular homeostasis.[5] An increase in MAP, initially after pneumoperitoneum, is usually noted which is caused by a squeeze of

blood from the abdominal cavity. After that MAP tends to maintain or decrease depend on a balance effect among pneumoperitoneum, anesthetic effect and an enhanced sympathetic activity following an increase in arterial CO_2 tension.[2] Bradycardia is common due to vagal stimulation.[2] Desmond & Gordon[6] reported cardiac arrhythmia in spontaneous breathing patients anesthetized with halothane and concluded that this group of patients should be ventilated mechanically. Scott[7] reported the incidence of cardiac arrhythmia during laparoscopy using halothane and spontaneous ventilation to be as high as 20 per cent. Halothane anesthesia is not recommended since it may cause severe cardiovascular depression during or after performing the pneumoperitoneum and increase the incidence of cardiac arrhythmia if hypercarbia occurs.[3] Although there are some controversies on spontaneous ventilation technique for laparoscopy, some institutes still perform this procedure under spontaneous ventilation.

In this study dehydrobenzperidol and pethidine were given for sedation and analgesic effect. Bradycardia was prevented by atropinization. A slight increase without any decrease in MAP during the procedure was noted which was possibly caused by an effect of atropine, an early response to pneumoperitoneum, a sympathetic stimulation to pain and an increase in $EtCO_2$. Heart rate initially increased postmedication and maintained throughout the procedure. An unopposed sedative effect and the lack of surgical stimulation could be an explanation of a significant decrease in MAP at postoperative period. Although a decrease in heart rate was noted at postoperative period compared to during the procedure, it was higher than the baseline control. This would be an effect of an increase in $EtCO_2$. Since this technique used local anesthesia plus sedation and spontaneous breathing, we anticipated a decrease in arterial O_2 tension and an increase in arterial CO_2 tension. Even if there was no clinically significant difference in mean SpO_2 and $EtCO_2$, there were 3 and 2 patients who had SpO_2 less than 92 per cent and $EtCO_2$ more than 50 mmHg respectively. We believed that the short operative time, an experienced surgeon and an ability of the patient to compensate for respiratory insult were the important factors which explained the result above.

Although the most acceptable technique for laparoscopy is general anesthesia, local anaesthesia had advantages over general anestesia in term of simplicity, low cost, avoidance of untoward effects of general anaesthesia and an ability to be done on a day case basis. Local anaesthesia still has some disadvantages such as a feeling of pain and discomfort, a possible risk of hypoxia and hypercapnia and a lack of prompt treatment

of airway problems.

Conclusion

We concluded from this study that diagnostic pelvic laparoscopy can be done under local anaesthesia plus systemic sedation. To overcome the feeling of pain and discomfort, intravenous titration of short acting sedative and analgesic agents during the procedure should be an answer. However the safety of the procedure probably depends more on short operative time, an experience of anesthetist and surgeon and careful hemodynamic and respiratory monitoring than the particular technique used.

Table 3 *Respiratory parameters (Et CO_2, RR) at different periods of time*

	C	PS	CO_2 in	CO_2 out	PO
$EtCO_2$ (mmHg)		*	*	*	*
Mean ± SD	37.51 ± 3.39	45.17 ± 4.39	39.8 ± 5.07	42.97 ± 4.58	42.97 ± 4.41
Range	29 - 44	36 - 53	25 - 47	31 - 50	32 - 51
RR (bpm)		*	*	*	*
Mean ± SD	18.17 ± 3.22	14.76 ± 5.57	22.14 ± 5.91	19.65 ± 4.0	15.51 ± 4.01
Range	12 - 25	6 - 37	12 - 37	10 - 28	8 - 26

* sig diff $p < 0.05$

Table 4 *Arterial blood gases at different periods of time*

	C	PS	CO_2 in	PO
pH.				
Mean ± SD	7.36 ± 0.04	7.32 ± 0.04*	7.31 ± 0.03*	7.32 ± 0.01*
Range	7.32 - 7.47	7.27 - 7.42	7.24 - 7.37	7.30 - 7.35
PaO_2 (torr)				
Mean ± SD	106.29 ± 8.68	97.27 ± 8.11	108.24 ± 8.74	115.38 ± 21.9
Range	92 - 123	83 - 105	91 - 116	90 - 152
$PaCO_2$ (torr)				
Mean ± SD	40.78 ± 3.77	47.28 ± 3.35*	43.33 ± 4.25*	42.96 ± 2.74*
Range	36 - 49	41 - 51	35 - 51	37 - 46

* sig diff $p < 0.05$

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